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Nuclear Science Abstracts

Vol. 7 No. 12A

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USAEC DECLASSIFIED REPORTS

AECD-3519 3347
Radiation Lab., Univ. of Calif., Berkeley
THE HEAT OF FORMATION OF THORIUM SESQUISULFIDE. LeRoy Eyring and Edgar F. Westrum, Jr. Apr. 7, 1953. Decl. May 4, 1953. 7p. (AECD-3519; UCRL-2175)

AECD-3520 3584
Argonne National Lab.
RADIOCHEMICAL INVESTIGATION OF THE SPONTANEOUS FISSION OF Cm^{242}. E. P. Steinberg and L. E. Glendenin. Mar. 13, 1953. Decl. May 1, 1953. 8p. (AECD-3520; ANL-OCS-329)

USAEC UNCLASSIFIED REPORTS

AECU-2457 3338
Georgetown Univ. Medical Center
DYNAMICS OF CALCIUM METABOLISM. I. TIME DISTRIBUTION OF INTRAVENOUSLY ADMINISTERED RADIOCALCIUM. R. O. Thomas, T. A. Litovitz, M. I. Rubin, and C. F. Geschickter. [1951]. 24p. (AECU-2457)

AECU-2463 3295
Sloan-Kettering Inst. for Cancer Research
SEMI-ANNUAL REPORT. Feb. 1, 1952. 95p. (AECU-2463)

AECU-2463(p.1-51) 3296
Sloan-Kettering Inst. for Cancer Research
PHYSICS AND BIOPHYSICS. p.1-51 of SEMI-ANNUAL REPORT. Feb. 1, 1952. 51p. (AECU-2463(p.1-51))

AECU-2463(p.52-95) 3297
Sloan-Kettering Inst. for Cancer Research
PROTEIN CHEMISTRY, IMMUNOCHEMISTRY, AND CLINICAL INVESTIGATION. p.52-95 of SEMI-ANNUAL REPORT. Feb. 1, 1952. 44p. (AECU-2463(p.52-95))

AECU-2494 3464
Laboratory for Nuclear Science, Mass. Inst. of Tech.
PROGRESS REPORT [FOR THE PERIOD NOVEMBER 30, 1952 TO FEBRUARY 28, 1953]. Feb. 28, 1953. 74p. (AECU-2494; [Progress Report 28])

AECU-2494(p.1-22) 3465
Laboratory for Nuclear Science, Mass. Inst. of Tech.
CHEMISTRY OF THE FISSION ELEMENTS GROUP and COSMIC RAY GROUP and ELEMENTARY PARTICLE SCATTERING GROUP. D. H. Hume, L. B. Rogers, B. Rossi, R. W. Williams, H. S. Bridge, and J. R. Zacharias. p.1-22 of PROGRESS REPORT [FOR THE PERIOD NOVEMBER 30, 1952 TO FEBRUARY 28, 1953]. Feb. 28, 1953. 22p. (AECU-2494(p.1-22))

AECU-2494(p.23-34) 3348
Laboratory for Nuclear Science, Mass. Inst. of Tech.
NUCLEAR CHEMISTRY (INORGANIC) GROUP and NUCLEAR CHEMISTRY (ORGANIC) GROUP. C. D. Coryell, J. W. Irvine, Jr., and J. D. Roberts. p.23-34 of PROGRESS REPORT [FOR THE PERIOD NOVEMBER 30, 1952 TO FEBRUARY 28, 1953]. Feb. 28, 1953. 12p. (AECU-2494(p.23-34))

AECU-2494(p.35-57) 3466
Laboratory for Nuclear Science, Mass. Inst. of Tech.
ONR GENERATOR GROUP and RADIOACTIVITY AND CYCLOTRON GROUP. W. W. Buechner, R. D. Evans, and M. S. Livingston. p.35-57 of PROGRESS REPORT [FOR THE PERIOD NOVEMBER 30, 1952 TO FEBRUARY 28, 1953]. Feb. 28, 1953. 23p. (AECU-2494(p.35-57))

AECU-2494(p.58-65) 3558
Laboratory for Nuclear Science, Mass. Inst. of Tech.
SYNCHROTRON GROUP and THEORETICAL GROUP. W. Kraushaar, L. S. Osborne, J. S. Clark, and V. F. Weisskopf. p.58-65 of PROGRESS REPORT [FOR THE PERIOD NOVEMBER 30, 1952 TO FEBRUARY 28, 1953]. Feb. 28, 1953. 8p. (AECU-2494(p.58-65))

AECU-2510 3397
Argonne National Lab.
INTERRELATIONSHIP OF HOLDUP AND THE APPROACH TO STEADY STATE IN BATCHWISE COUNTERCURRENT LIQUID-LIQUID EXTRACTION. Donald F. Peppard and Marvila A. Peppard. Mar. 1953. 29p. (AECU-2510; UAC-737)

AECU-2511 3467
Argonne National Lab.
THEORY OF A-C SPACE-CHARGE POLARIZATION EFFECTS IN PHOTOCONDUCTORS, SEMICONDUCTORS, AND ELECTROLYTES. J. Ross Macdonald. Mar. 3, 1953. 54p. (AECU-2511; UAC-733)

AECU-2512 3339
Institute for the Study of Rate Processes, Univ. of Utah
PHOTOSYNTHESIS, A REVIEW; STUDIES OF PHOTOSYNTHETIC PROCESSES. Rufus Lumry, John D. Spikes, and Henry Eyring. Feb. 1, 1953. 35p. (AECU-2512; Technical Report 8)

AECU-2514 3389
Chicago Univ.
THE EPITHERMAL REACTIONS OF RECOIL ATOMS (thesis). Frank S. Rowland. Aug. 1952. 77p. (AECU-2514)

AECU-2516 3340
Wisconsin Univ.
HOST RESPONSES ASSOCIATED WITH THE DEVELOPMENT OF OAK WILT. C. H. Beckman, J. E. Kuntz, A. J. Riker, and J. G. Berbee. [1952]. 24p. (AECU-2516)

AECU-2517 3341
McCollum-Pratt Inst., Johns Hopkins Univ.
RADIO-ASSAY OF COBALT-60. Robert Ballentine and Dorothy D. Burford. [1952]. 29p. (AECU-2517)

AECU-2518 3298
McCollum-Pratt Inst., Johns Hopkins Univ.
THE BIOSYNTHESIS OF STABLE COBALTO-PROTEINS BY PLANTS. II. INTERACTION OF IRON AND COBALT METABOLISM IN NEUROSPORA CRASSA. Robert Ballentine. [1952]. 22p. (AECU-2518)

AECU-2519 3299
Laboratory of Biochemistry, Univ. of Ill.
LACTOSE METABOLISM. 1. CARBOHYDRATE METABOLISM OF L. BULGARICUS STRAIN GERE A. W. J. Rutter and R. G. Hansen. [1952]. 24p. (AECU-2519)

AECU-2520 3301
Washington Univ. School of Medicine, St. Louis
EFFECT OF SUBLETHAL TOTAL BODY X-RADIATION ON SUSCEPTIBILITY OF MICE TO SALMONELLA ENTERITIDIS AND ESCHERICHIA COLI. I. L. Shechmeister, L. J. Paulissen, and M. Fishman. [1953]. 14p. (AECU-2520)

AECU-2521 3302
New England Deaconess Hospital, Boston
THE EFFECTS OF IONIZING RADIATION, CERTAIN HORMONES, AND RADIOMIMETIC DRUGS ON THE DEVELOPING NERVOUS SYSTEM. Samuel P. Hicks, New England Deaconess Hospital, Boston and Harvard Medical School. [1953]. 31p. (AECU-2521)

AECU-2522 3342
Michigan State Coll.
RADIOISOTOPES IN RESEARCH ON NUTRITION OF FRUIT CROPS. S. H. Wittwer and H. B. Tuckey. [1953]. 25p. (AECU-2522)

AECU-2524 3509
Chicago Univ.
METHOD FOR THE ROUTINE ABSOLUTE INTENSITY AND ENERGY MEASUREMENTS OF BETA RADIATION; APPLICATION TO NATURALLY RADIOACTIVE POTASSIUM, RUBIDIUM, RHENIUM AND LUTETIUM (thesis). Andrew D. Suttle, Jr. Aug. 1952. 106p. (AECU-2524)

AECU-2525 3468
Michigan Univ.
INSTALLATION AND OPERATION OF TEN-KILOCURIE COBALT-60 GAMMA RADIATION SOURCE. John V. Nehemias, L. E. Brownell, W. W. Meinke, and E. W. Coleman. [1952]. 10p. (AECU-2525)

AECU-2526 3553
Argonne National Lab.
INNER BREMSSTRAHLUNG AND THE MAGNETIC MOMENT OF THE NEUTRINO. E. J. Hellund. Mar. 1953. 2p. (AECU-2526; UAC-734)

AECU-2528 3498
David Sarnoff Research Center
ELECTRONIC DEVICES FOR NUCLEAR PHYSICS; QUARTERLY REPORT [FOR] OCTOBER 1952–JANUARY 1953. G. A. Morton, P. W. Davison, M. W. Green, and M. H. Greenblatt. Apr. 13, 1953. 22p. (AECU-2528; Quarterly Report 10)

AECU-2530 3343
Lankenau Hospital Research Inst., Philadelphia
A STUDY OF ACETATE METABOLISM AND FATTY ACID SYNTHESIS IN LIVER SLICES OF HYPERTHYROID RATS. Morris A. Spirtes, Grace Medes, and Sidney Weinhouse. Lankenau Hospital Research Inst., Philadelphia and Institute for Cancer Research, Philadelphia. [1952]. 19p. (AECU-2530)

AECU-2531 3402
Lankenau Hospital Research Inst., Philadelphia
NON-ENZYMATIC TRANSAMINATION WITH GLYOXYLIC ACID AND VARIOUS AMINO ACIDS. Henry I. Nakada and Sidney Weinhouse. Lankenau Hospital Research Inst., Philadelphia and Institute for Cancer Research, Philadelphia and Temple Univ. [1953]. 13p. (AECU-2531)

ANL-5022 3386
Argonne National Lab.
SERVOS FOR REMOTE MANIPULATION. R. C. Goertz, J. R. Burnett, and F. Bevilacqua. Mar. 26, 1953. 26p. (ANL-5022)

BMI-813 3446
Battelle Memorial Inst.
INTRODUCTORY PLATING STUDIES ON PROTECTING MOLYBDENUM FROM HIGH-TEMPERATURE OXIDATION. L. E. Vaaler, C. A. Snavely, and C. L. Faust. Apr. 1, 1953. 20p. (BMI-813)

BNL-1362 3511
Brookhaven National Lab.
ON THE SURFACE EFFECT OF SODIUM IODIDE SCINTILLATORS. E. der Mateosian and Luke C. L. Yuan. [1952]. 6p. (BNL-1362)

BNL-1364 3496
Brookhaven National Lab.
THE EFFECT OF ISOTOPIC SUBSTITUTION ON THE ENTROPY, ENTHALPY AND HEAT CAPACITY OF IDEAL GASES. 1. SYSTEMS IN THERMAL EQUILIBRIUM. 2. CHEMICALLY REACTING SYSTEMS. Jacob Bigeleisen. [1952]. 22p. (BNL-1364)

ISC-325 3349
Ames Lab.
THE REACTION BETWEEN CALCIUM METAL AND WATER VAPOR. [PART] I. Harry J. Svec and Dale S. Gibbs. [Mar. 30, 1953]. 9p. (ISC-325)

ISC-328 3373
Ames Lab.
THE STRUCTURE AND RESIDUAL ENTROPY OF ICE. R. E. Rundle, Institute for Atomic Research, Iowa State Coll. and Ames Lab. [Mar. 25, 1953]. 5p. (ISC-328)

ISC-329 3548
Ames Lab.
AN LCAO MO SELF-CONSISTENT FIELD CALCULATION OF THE GROUND STATE OF H_2O. Frank O. Ellison and Harrison Shull. [Mar. 30, 1953]. 8p. (ISC-329)

KAPL-857 3360
Knolls Atomic Power Lab.
THE QUANTITATIVE DETERMINATION OF PPM OF OXYGEN IN GASES. L. P. Pepkowitz and E. L. Shirley. Dec. 1, 1952. 24p. (KAPL-857)

KLX-1386 3410
Vitro Corp. of America
SURVEY ON WASTE DISPOSAL: DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT [FOR] JANUARY 1, 1953–FEBRUARY 28, 1953: JOB 24A. Mar. 18, 1953. 10p. (KLX-1386)

KLX-1389 3411
Vitro Corp. of America
DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT (24-A4); PROJECT SUMMARY [FOR] SEPTEMBER 1, 1950–APRIL 30, 1953, JOB 24-A. May 1, 1953. 48p. (KLX-1389)

LA-1510 3513
Los Alamos Scientific Lab.
LABORATORY HANDBOOK OF NUCLEAR MICROSCOPY. J. C. Allred and A. H. Armstrong. Feb. 1953. 62p. (LA-1510)

LA-1527 3324
Los Alamos Scientific Lab.
STUDIES ON THE MECHANISM OF ACTION OF THERMAL

NEUTRONS IN PRODUCING BIOLOGICAL EFFECTS. I. LACK OF EFFECT OF HYPOXIA AND GLUTATHIONE IN ALTERING MORTALITY IN MICE. John B. Storer, L. Edward Ellinwood, Wright H. Langham, and Phyllis Sanders Mar. 1953. 24p. (LA-1527)

MTA-13 3586
Livermore Research Lab., Calif. Research and Development Co.
THE CROSS SECTION FOR THE REACTION $Al^{27}(\alpha,\alpha 2pn)Na^{24}$ FROM THRESHOLD TO 380 MEV. M. Lindner and R. N. Osborne. Jan. 8, 1953. 13p. (MTA-13)

NYO-925 3453
Massachusetts Inst. of Tech.
THERMODYNAMICS OF METAL SOLUTIONS; TECHNICAL REPORT, SCOPE 1. Michael B. Bever, George Scatchard, and Carl Wagner. Apr. 27, 1953. 36p. (NYO-925)

NYO-3013 3454
Pennsylvania Univ.
[SUPERCONDUCTIVITY STUDIES.] ANNUAL REPORT. William F. Love, E. Passaglia, T. Croft, and F. Donahoe. Nov. 1952. 67p. (NYO-3013)

NYO-3162 3380
New Hampshire Univ.
[STUDIES OF FLUORIDES]; PROGRESS REPORT. Helmut M. Haendler. Oct. 15, 1952. 39p. (NYO-3162)

NYO-3329 3393
Columbia Univ.
UTILIZATION OF WASTE FISSION PRODUCTS IN CHEMICAL REACTION. A. Czikk, J. Dempsey, S. Engel, and W. A. Selke. Apr. 1, 1953. 15p. (NYO-3329)

NYO-3761 3384
Alfred Univ.
GRAPHITIZATION OF CARBON; TECHNICAL PROGRESS REPORT. V. D. Frechette and Yung Tao. Mar. 31, 1953. 7p. (NYO-3761)

NYO-4437 3325
Sedgwick Labs. of Sanitary Science, Mass. Inst. of Tech.
ASSAYING TECHNIQUES FOR RADIOISOTOPIC CONTAMINANTS IN WATER SUPPLIES. A. Gordon Wheler, Jr., Warren J. Kaufman, and Rolf Eliassen. July 1, 1952. 73p. (NYO-4437)

NYO-4438 3303
Sedgwick Labs. of Sanitary Science, Mass. Inst. of Tech.
EFFECT OF BETA RADIATION UPON BIOCHEMICAL OXIDATION IN POLLUTED WATERS. Rolf T. Skrinde and Clair N. Sawyer. Sept. 30, 1952. 55p. (NYO-4438)

NYO-4524 3326
New York Operations Office, AEC
RADIOACTIVE CONTAMINATION SAMPLING BY SMEARS AND ADHESIVE DISCS. Eugene V. Barry and Leonard R. Solon. May 1953. 10p. (NYO-4524)

NYO-6198 3430
Lamont Geological Observatory, Columbia Univ.
AGE DETERMINATION OF URANIUM MINERALS BY Pb^{210}. J. Laurence Kulp, Wallace S. Broecker, and Walter R. Eckelmann. [1953]. 14p. (NYO-6198)

NYO-6202 3518
Lamont Geological Observatory [Columbia Univ.]
A LOW LEVEL RADON COUNTING SYSTEM. G. L. Bate, H. L. Volchok, and J. L. Kulp. [nd] 20p. (NYO-6202)

ORO-92 3344
Texas Agricultural Experiment Station
DIHYDROXYACETONE ESTERS AS PRECURSORS OF TRIGLYCERIDES DURING INTESTINAL ABSORPTION. Raymond Reiser and Mary Carr Williams. [1952]. 10p. (ORO-92)

ORO-93 3412
Tennessee Univ.
EFFECT OF WETTING ON HEAT TRANSFER CHARACTERISTICS OF LIQUID METALS (thesis). W. K. Stromquist. Mar. 1953. 182p. (ORO-93)

ORNL-1488 3327
Oak Ridge National Lab.
HEALTH PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 20, 1953. Issued Mar. 30, 1953. 17p. (ORNL-1488)

ORNL-1525 3501
Oak Ridge National Lab.
FILAMENT LIFE EXTENSION IN HIGH-INTENSITY ION SOURCES. O. C. Yonts. Issued Apr. 27, 1953. 10p. (ORNL-1525)

ORNL-1526 3519
Oak Ridge National Lab.
A NEUTRON TIME-OF-FLIGHT SPECTROMETER (thesis). Gerard S. Pawlicki. Issued Apr. 24, 1953. 52p. (ORNL-1526)

R-240(RAND) 3602
RAND Corp.
GAMMA-RAY TRANSMISSION THROUGH FINITE SLABS. G. H. Peebles. Dec. 1, 1952. 203p. (R-240(RAND))

RME-2 3431
Division of Raw Materials, AEC
EXPLORATION DRILLING TECHNIQUES ON THE COLORADO PLATEAU. John P. Kellogg. Nov. 12, 1952. 22p. (RME-2)

RME-3033 3432
Pennsylvania State Coll. School of Mineral Industries
AN INVESTIGATION OF THE MINERALOGY OF URANIUM-BEARING DEPOSITS IN THE BOULDER BATHOLITH, MONTANA: PROGRESS REPORT [FOR] PERIOD OCTOBER 1, 1952–DECEMBER 31, 1952. B. H. Bieler and H. D. Wright. 20p. (RME-3033; Progress Report 2)

RME-3040 3433
Minnesota Univ.
URANIUM OCCURRENCE IN ASPHALTITES; TECHNICAL REPORT [FOR] JUNE 1, 1952 TO MARCH 31, 1953. Thomas D. O'Brien. Mar. 31, 1953. 9p. (RME-3040)

RME-3044 3434
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ANNUAL REPORT FOR JULY 1, 1952 TO MARCH 31, 1953. John W. Gruner, Lynn Gardiner, and Deane K. Smith, Jr. Issued Apr. 1, 1953. 58p. (RME-3044)

RME-3045 3435
Stanford Univ.
PART 1. STUDIES OF THE MINOR ACCESSORY CONSTITUENTS IN SOME CALIFORNIA BEACH SANDS. PART 2. OPTICAL AND CHEMICAL STUDIES OF MINERALS CONTAINING TANTALUM, NIOBIUM, TITANIUM AND URANIUM AS A PRELIMINARY TO INVESTIGATION OF THE MINERALOGY OF SOME IDAHO PLACER DEPOSITS; ANNUAL TECHNICAL REPORT FOR APRIL 1, 1952 TO MARCH 31, 1953. C. Osborne Hutton. Issued Apr. 1, 1953. 9p. (RME-3045)

RME-3047 3436
Pennsylvania State Coll.
PETROGRAPHICAL INVESTIGATIONS OF THE SALT WASH SEDIMENTS: PROGRESS REPORT [FOR] DECEM-

BER 1, 1952 TO MARCH 1, 1953. J. S. Kahn, D. W. Groff, and John C. Griffiths. Issued Mar. 1953. 55p. (RME-3047)

RME-3048 3403
Harvard Univ.
THE SYNTHESIS OF ZIRCONIUM, THORIUM AND URANIUM SILICATES; TECHNICAL REPORT FOR JULY 1, 1952 TO MARCH 31, 1953. Clifford Frondel and Richard L. Collette. Mar. 30, 1953. 29p. (RME-3048)

RMO-44 3437
Amherst Coll.
EXPERIMENTAL SIMULATION OF PLATEAU TYPE URANIUM DEPOSITS. George W. Bain. Issued Jan. 1953. 210p. (RMO-44)

RMO-1036 3438
Division of Raw Materials, AEC
BIBLIOGRAPHY AND INDEX OF PUBLISHED LITERATURE ON URANIUM AND THORIUM OCCURRENCES IN THE UNITED STATES. PART 2. CALIFORNIA, IDAHO, MONTANA, OREGON, WASHINGTON, AND WYOMING. Margaret Cooper. Issued Dec. 1952. 156p. (RMO-1036)

SO-2027 3456
General Electric Research Lab.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; SEVENTEENTH QUARTERLY REPORT. J. H. Hollomon and D. Turnbull. Apr. 5, 1953. 14p. (SO-2027; Progress Report 34; RL-867)

SO-2509 3457
General Electric Research Lab.
DEVELOPMENT OF ZIRCONIUM BASE ALLOYS; FOURTEENTH QUARTERLY REPORT. J. H. Keeler. Apr. 5, 1953. 9p. (SO-2509; Progress Report 15; RL-868)

UCLA-252 3300
Atomic Energy Project, Univ. of Calif., Los Angeles
COMPARATIVE EFFECTS OF HIGH EXPLOSIVE BLAST ON MECHANICALLY CONSTRAINED MICE AND RATS. B. Cassen, H. Gass, and K. Kistler. Issued Apr. 30, 1953. 11p. (UCLA-252)

UCLA-253 3394
Atomic Energy Project, Univ. of Calif., Los Angeles
THE EFFECT OF CERTAIN VITAMINS AND ANTIOXIDANTS ON THE IRRADIATION-INDUCED AUTOXIDATION OF METHYL LINOLEATE. Barbara Hinderer Polister and James F. Mead. Submitted Apr. 27, 1953. 20p. (UCLA-253)

UCRL-2051 3495
Radiation Lab., Univ. of Calif., Berkeley
PARTICLE INITIATED HIGH VACUUM SPARKS. Harry G. Heard and Eugene J. Lauer. Mar. 16, 1953. 13p. (UCRL-2051)

UCRL-2056 3304
Radiation Lab., Univ. of Calif., Berkeley
AN ELECTROPHYSIOLOGICAL STUDY OF SOME PROPERTIES OF THE VERTEBRATE RETINA (thesis). Leo E. Lipetz. Jan. 1953. 147p. (UCRL-2056)

UCRL-2057 3413
Radiation Lab., Univ. of Calif., Berkeley
EFFECT OF FLUID PROPERTIES ON MASS TRANSFER IN THE GAS PHASE (thesis). Edward J. Lynch. Jan. 1953. 114p. (UCRL-2057)

UCRL-2078 3599
Radiation Lab., Univ. of Calif., Berkeley
AN ION SOURCE FOR THE 184-INCH SYNCHROCYCLOTRON Warren Fenton Stubbins. Jan. 23, 1953. 12p. (UCRL-2078)

UCRL-2121 3600
Radiation Lab., Univ. of Calif., Berkeley
SUMMARY OF RESEARCH PROGRESS MEETING OF DECEMBER 11 AND 18, 1952. Sergey Shewchuck. Mar. 11, 1953. 10p. (UCRL-2121)

UCRL-2153 3603
Radiation Lab., Univ. of Calif., Berkeley
A HIGH-PRESSURE CLOUD-CHAMBER INVESTIGATION OF PROTONS SCATTERED BY 300 MEV NEUTRONS (thesis). John De Pangher, Jr. Mar. 17, 1953. 80p. (UCRL-2153)

UCRL-2154 3404
Radiation Lab., Univ. of Calif., Berkeley
PREPARATION OF DL-VALINE-4,4'-C_2^{14}, DL-NORVALINE-3-C^{14}, DL-LEUCINE-3-C^{14}, DL-NORLEUCINE-3-C^{14}. R. Ostwald. Mar. 27, 1953. 15p. (UCRL-2154)

Y-951 3350
Carbide and Carbon Chemicals Co. (Y-12)
SELECTED PROPERTIES OF 2-FURALDEHYDE: A LITERATURE SEARCH. Frances L. Sachs. Apr. 9, 1953. 28p. (Y-951)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE-C/R-1041 3358
Atomic Energy Research Establishment, Harwell, Berks (England)
THE ANALYSIS OF URANIUM-GALLIUM ALLOYS. G. W. C. Milner and A. J. Wood. Nov. 5, 1952. 16p. (AERE-C/R-1041)

AERE-C/R-1124 3547
Atomic Energy Research Establishment, Harwell, Berks (England)
THE INFRA-RED SPECTRA AND MOLECULAR STRUCTURE OF SOME INORGANIC HEXAFLUORIDES. PART 3. SeF_6 AND TeF_6. J. Gaunt. Mar. 5, 1953. 14p. (AERE-C/R-1124)

AERE-M/R-1099 3424
Atomic Energy Research Establishment, Harwell, Berks (England)
A FUNDAMENTAL INVESTIGATION OF SINTERING PHENOMENA. E. B. Allison and P. Murray. Jan. 1953. 42p. (AERE-M/R-1099)

AERE-M/R-1106 3372
Atomic Energy Research Establishment, Harwell, Berks (England)
A STUDY OF THE MONOCLINIC TO TETRAGONAL PHASE TRANSFORMATION IN ZIRCONIA. P. Murray and E. B. Allison. Jan. 21, 1953. 35p. (AERE-M/R-1106)

AERE-Med/R-1101 3331
Atomic Energy Research Establishment, Harwell, Berks (England)
A COMPARISON OF RADIOGRAPHIC TECHNIQUES WITH SPECIAL REFERENCE TO DOSAGE. G. M. Ardran and H. E. Crooks. Jan. 19, 1953. 10p. (AERE-Med/R-1101)

AERE-T/R-1093 3598
Atomic Energy Research Establishment, Harwell, Berks (England)
LINEAR ACCELERATOR WITH SPIRAL ORBITS. J. S. Bell. Jan. 1953. 20p. (AERE-T/R-1093)

AF-TR-5662(pt. 4) 3418
Research Foundation, Ohio State Univ.
INVESTIGATION OF MECHANICAL PROPERTIES AND PHYSICAL METALLURGY OF AIRCRAFT ALLOYS AT VERY LOW TEMPERATURES. PART 4. LOW-TEMPER-

ATURE MECHANICAL PROPERTIES INCLUDING FATIGUE OF TITANIUM-BASE ALLOYS RC-130-B AND Ti-150-A. Joseph W. Spretnak and Mars G. Fontana. Nov. 1952. 40p. (AF-TR-5662(pt. 4))

AMRL-109 3323
Army Medical Research Lab., Fort Knox
THE RADIOACTIVITY OF THE NORMAL HUMAN BODY, A CONTRIBUTION TO THE PRESENT SITUATION. A. T. Krebs. Jan. 12, 1953. 14p. (AMRL-109)

ATI-109383 3425*
Armour Research Foundation
INVESTIGATION OF REFRACTORIES SUITABLE FOR MELTING TITANIUM AND ITS ALLOYS. L. E. Marchi and W. A. Scholes. June 10, 1951. 19p. (ATI-109383; Report 1)

ATI-111887 3390*
Laboratories for Research and Development, Franklin Inst.
CHEMICAL SYSTEMS SENSITIVE TO RADIATION: MONTHLY PROGRESS REPORT [FOR] JUNE 14, 1951 TO JULY 31, 1951. James Vollmer. 7p. (ATI-111887; Monthly Progress Report P-2260-1)

ATI-112063 3546*
New York Univ., Coll. of Engineering
EXPERIMENTAL STUDIES OF SMALL SCALE TURBULENCE: PROGRESS REPORT [FOR] DECEMBER 1, 1950 TO FEBRUARY 28, 1951. James E. Miller, A. K. Blackadar, Bernard Shorr, and David Slade. Feb. 28, 1951. 34p. (ATI-112063; Progress Report 142-03)

ATI-115189 3391*
Illinois Univ.
STUDIES OF EFFECTS OF HIGH ENERGY RADIATION ON CHEMICAL SYSTEMS; BIMONTHLY PROGRESS REPORT [FOR] JUNE 15, 1951 TO AUGUST 15, 1951. G. L. Clark, J. Fuchs, P. E. Bierstedt, and J. O. Gardner. 7p. (ATI-115189; Bimonthly Progress Report 1)

ATI-115466 3510*
School of Aviation Medicine
EVALUATION OF THE LAND SELF-DEVELOPING FILM BADGE DOSIMETER. John E. Pickering. May 1951. 7p. (ATI-115466)

ATI-116834 3329*
School of Aviation Medicine
BONE MARROW IMPLANTS IN THE TREATMENT OF RADIATION SICKNESS. John M. Talbot and Herbert B. Gerstner. Sept. 1951. 16p. (ATI-116834)

ATI-117136 3585*
Purdue Univ.
EXCITATION CURVES OF (ALPHA, NEUTRON) AND (ALPHA, TWO-NEUTRON) REACTIONS IN SILVER^{109} (thesis). Albert Kellogg Stebbins, III. Aug. 1951. 49p. (ATI-117136)

ATI-117710 3429
Lamont Geological Observatory, Columbia Univ.
NATURAL RADIOCARBON 14 MEASUREMENT AND APPLICATIONS; QUARTERLY PROGRESS REPORT 4 AND 5. J. Laurence Kulp. July 15, 1951. 18p. (ATI-117710; Quarterly Progress Report 4 and 5)

ATI-164576 3359
Chemical Inspectorate, Ministry of Supply, London (England)
DETERMINATION OF MICROGRAM AMOUNTS OF BERYLLIUM USING ACETYL ACETONE. J. A. Adam, E. Booth, and J. D. H. Strickland. [Feb. 1952]. 15p. (ATI-164576; CI/R-52)

BLR-51-57 3419
Bell Aircraft Corp.
GENERAL PROGRAM FOR THE EVALUATION OF TITANIUM AND TITANIUM-BASE ALLOYS AT BELL AIRCRAFT CORPORATION. A. Leach. Apr. 3, 1951. 148p. (BLR-51-57)

CRL/AE-102 3512
Chemical Research Lab., Teddington, Middlesex (England)
THE C^{14} COUNTING EFFICIENCY AND BACKGROUND OF A LIQUID SCINTILLATION COUNTER. B. N. Audric and J. V. P. Long. Mar. 1953. 13p. (CRL/AE-102)

JENER-1 3581
Joint Establishment for Nuclear Energy Research (Norway)
CALCULATIONS ON NEUTRON FLUX DISTRIBUTION IN THE JEEP. M. Bogaardt. Nov. 20, 1951. 18p. (JENER-1)

JENER-14 3582
Joint Establishment for Nuclear Energy Research (Norway)
INSPECTION OF THE RODS IN JEEP DURING THE PERIOD DECEMBER 1–7, 1952. J. Brun. Jan. 31, 1953. 13p. (JENER-14)

NP-4369 3379
Cryogenic Lab., Ohio State Univ.
THE DENSITY AND SURFACE TENSION OF LIQUID FLUORINE BETWEEN 66° AND 80° K. David White, Jih-Heng Hu, and H. L. Johnston. Feb. 1, 1953. 19p. (NP-4369; Technical Report 19; TR-283-19)

NP-4370 3447
Battelle Memorial Inst.
THE WELDING OF BETA-STABILIZED TITANIUM ALLOYS; PROGRESS REPORT [FOR MARCH 18, 1952 TO OCTOBER 1, 1952]. G. E. Faulkner, G. B. Grable, and C. B. Voldrich. Oct. 1, 1952. 44p. (NP-4370; WAL-401/97-15)

NP-4400 3514
Institute of Industrial Research, Syracuse Univ.
NON-ELECTRONIC DOSE RATE INDICATING SYSTEMS: QUARTERLY PROGRESS REPORT [FOR] SEPTEMBER 15–DECEMBER 15, 1952. Myron G. Berry and Henry Linschitz. 132p. (NP-4400; Quarterly Progress Report 2)

NP-4401 3515
Polaroid Corp.
DEVELOPMENT OF PHOTODOSIMETERS OF THE "DRY DEVELOPMENT" TYPE: FINAL REPORT [FOR] APRIL 1, 1951 TO DECEMBER 1, 1952. Dwight P. Merrill. [nd] 87p. (NP-4401)

NP-4405 3420
Metals Research Lab., Case Inst. of Tech.
STRAIN AGING AND RHEOTROPIC RECOVERY; AN INVESTIGATION OF THE EFFECTS OF STRESS CONCENTRATION AND TRIAXIALITY ON THE PLASTIC FLOW OF METALS. E. J. Ripling. Feb. 1953. 26p. (NP-4405; Technical Report 25)

NP-4434 3392
Polytechnic Inst. of Brooklyn
INSULATION; INTERIM REPORT COVERING THE PERIOD JULY 1, 1951 TO SEPTEMBER 30, 1951. J. Steigman, A. Copperman, A. Bender, J. Goodman, and R. Corth. Oct. 15, 1951. 32p. (NP-4434; Interim Report 1)

NP-4466 3469
Research Lab. of Electronics, Mass. Inst. of Tech.
ELECTROMAGNETIC WAVE PROPAGATION ON HELICAL CONDUCTORS. Samuel Sensiper. May 16, 1951. 123p. (NP-4466; Technical Report 194)

NP-4486 3361
Armour Research Foundation
QUANTITATIVE SPECTROGRAPHIC ANALYSIS FOR OXYGEN IN TITANIUM METAL; FINAL TECHNICAL REPORT. K. L. Yudowitch. July 25, 1952. 39p. (NP-4486)

NP-4487 3421
Metals Research Lab., Case Inst. of Tech.
NOTCH SENSITIVITY OF STEELS; AN INVESTIGATION OF THE EFFECTS OF STRESS CONCENTRATION AND TRIAXIALITY ON THE PLASTIC FLOW OF METALS. E. J. Ripling. Mar. 1953. 25p. (NP-4487; Technical Report 26)

NP-4488 3516
De Paul Univ.
SCINTILLATION TECHNIQUES APPLIED TO ELECTRON ENERGY STUDIES: QUARTERLY PROGRESS REPORT [FOR] OCTOBER 1, 1952 TO DECEMBER 31, 1952. Edwin J. Schillinger, Jr. 18p. (NP-4488; Quarterly Progress Report 3)

NP-4492 3448•
Utah Univ.
AN ABSTRACT COMPILATION OF THE LITERATURE ON HIGH TEMPERATURE OXIDATION OF METALS. W. Martin Fassell, Jr., Martha S. Chamberlain, and Robert C. Peterson. [nd] 330p. (NP-4492; Technical Report 3, (pt. 2))

NP-4494 3640
Harvard Univ.
THE THEORY OF QUANTIZED FIELDS. II. Julian Schwinger. [1951]. 47p. (NP-4494)

NP-4502 3422
Institute of Engineering Research, Univ. of Calif., Berkeley
CREEP CORRELATIONS OF METALS AT ELEVATED TEMPERATURES: TECHNICAL REPORT. Oleg D. Sherby, Raymond L. Orr, and John E. Dorn. Mar. 1, 1953. 43p. (NP-4502; Technical Report 25)

NP-4507 3506
California Univ., Berkeley
DEGENERATE PERTURBATIONS. David C. Kleinecke. Feb. 1953. 18p. (NP-4507; Technical Report 1)

NP-4526 3470
Naval Research Lab., Univ. of Wis.
THE QUANTUM MECHANICS OF COLLISIONS BETWEEN DIATOMIC MOLECULES. C. F. Curtiss. Jan. 30, 1953. 23p. (NP-4526)

NP-4529 3423
Armour Research Foundation
THE EFFECTS OF CARBON, PHOSPHOROUS, AND ALLOY CONTENTS ON THE NOTCHED BAR IMPACT PROPERTIES OF QUENCHED AND TEMPERED STEELS. H. Schwartzbart and J. P. Sheehan. Feb. 24, 1953. 166p. (NP-4529; Report 39)

NP-4532 3449
Battelle Memorial Inst.
PRODUCTION OF SOUND DUCTILE JOINTS IN MOLYBDENUM; QUARTERLY PROGRESS REPORT [FOR OCTOBER 21, 1952 TO JANUARY 20, 1953]. M. L Jacobson, D. C. Martin, and C. B. Voldrich. Jan. 30, 1953. 29p. (NP-4532)

NP-4533 3613
Sarah Mellon Scaife Radiation Lab., Univ. of Pittsburgh
RADIATION DAMAGE STUDY; REPORT FOR AUGUST AND SEPTEMBER 1952. 8p. (NP-4533; Report 3)

NP-4534 3614
Sarah Mellon Scaife Radiation Lab., Univ. of Pittsburgh
RADIATION DAMAGE STUDY; REPORT [FOR] JUNE [AND] JULY 1952. 12p. (NP-4534; Report 2)

NP-4539 3480
Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)
CONCORD OF COSMIC RAY COMPONENTS IN THE ATMOSPHERE. P. Budini, Trieste Univ. (Italy) and G. Moliere, Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil). Dec. 28, 1952. 24p. (NP-4539; Physics Note 10)

NP-4540 3517
Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)
NOTE ON THE DIFFUSION OF RADIOELEMENTS IN NUCLEAR EMULSION. Elisa Frota-Pessôa. Dec. 30, 1952. 8p. (NP-4540; Physics Note 11)

NP-4541 3549
Solid-State and Molecular Theory Group, Mass. Inst. of Tech.
ELECTRONIC STRUCTURE OF ATOMS AND MOLECULES. John C. Slater. Feb. 15, 1953. 216p. (NP-4541; Technical Report 3)

NP-4542 3499
Columbia Radiation Lab., Columbia Univ.
FOURTH QUARTERLY PROGRESS REPORT FOR THE YEAR 1952. Dec. 31, 1952. 39p. (NP-4542; Quarterly Progress Report 4)

NP-4544 3426
Armour Research Foundation
STRESS CORROSION IN AIRCRAFT ALLOYS: FINAL REPORT. Joseph B. McAndrew and Howard T. Francis. May 29, 1952. 23p. (NP-4544)

NP-4546 3401
Spectroscopy Lab., Ill. Inst. of Tech.
SUBSTITUTED METHANES. 16. VIBRATIONAL SPECTRA, POTENTIAL CONSTANTS, AND CALCULATED THERMODYNAMIC PROPERTIES OF DIBROMODIFLUOROMETHANE; TECHNICAL REPORT ON MOLECULAR SPECTROSCOPY, MOLECULAR STRUCTURE AND THERMODYNAMICS [FOR] SEPTEMBER 15, 1951 TO SEPTEMBER 14, 1952. Charlotte E. Decker, Arnold G. Meister, Forrest F. Cleveland, and Richard B. Bernstein. Submitted Apr. 22, 1953. 12p. (NP-4546; Technical Report 12)

NP-4551 3550
Solid-State and Molecular Theory Group, Mass. Inst. of Tech.
[SOLID-STATE AND MOLECULAR THEORY]; QUARTERLY PROGRESS REPORT. Apr. 15, 1953. 72p. (NP-4551; Quarterly Progress Report 8)

NP-4552 3450
Massachusetts Inst. of Tech.
THE GRINDING OF TITANIUM ALLOYS. C. T. Yang and M. C. Shaw. Apr. 1953. 77p. (NP-4552)

NP-4553 3451
Howard Univ.
THE ELECTRODEPOSITION OF BISMUTH; A TECHNICAL REPORT. Kelso B. Morris. Apr. 11, 1953. 12p. (NP-4553)

NRL-4131 3452
Naval Research Lab.
THE SOLUBILITY OF IRON IN SODIUM METAL, SODIUM-SODIUM OXIDE, AND SODIUM-SODIUM OXIDE-SODIUM HYDROXIDE. Andrew D. Bogard. Mar. 9, 1953. 10p. (NRL-4131)

NRL-4133 3500
Naval Research Lab.
A THREE-LEVEL CAPILLARY VISCOMETER FOR THE STUDY OF ANOMALOUS FLOW IN SEALED SYSTEMS. John G. Honig and C. R. Singleterry. Apr. 14, 1953. 13p. (NRL-4133)

RAE-MET-69 3455
Royal Aircraft Establishment, Farnborough, Hants (England)
THE YOUNG'S MODULUS, POISSON'S RATIO AND RIGIDITY MODULUS OF SOME ALUMINIUM ALLOYS: PART 2. N. Dudzinski. Nov. 1952. 30p. (RAE-MET-69)

TEI-307 3439
Geological Survey
AN AIR CONCENTRATOR FOR VERY LOW GRADE COLORADO PLATEAU URANIUM ORES. L. R. Stieff and E. S. Erickson, Jr. Jan. 1953. 13p. (TEI-307)

USNRDL-389 3305
Naval Radiological Defense Lab.
THE CAUSE OF INCREASED SUSCEPTIBILITY TO AVIRULENT PASTEURELLA PESTIS AFTER EXPOSURE TO A SUBLETHAL DOSE OF X IRRADIATION. M. S. Silverman, P. H. Chin, V. Greenman, and J. C. Young. Jan. 4, 1953. 17p. (USNRDL-389)

WAL-401/103-18 3458
Armour Research Foundation
RESEARCH AND DEVELOPMENT TOWARD IMPROVING TITANIUM-ALUMINUM BINARY ALLOYS BY THE ADDITION OF A THIRD COMPONENT: SUMMARY REPORT. H. D. Kessler. [1953]. 103p. (WAL-401/103-18)

WAL-401/103-22 3459
Armour Research Foundation
RESEARCH AND DEVELOPMENT TOWARD IMPROVING TITANIUM-ALUMINUM BINARY ALLOYS BY THE ADDITION OF A THIRD COMPONENT: INTERIM TECHNICAL REPORT FOR SEPTEMBER 1, 1952–DECEMBER 31, 1952. 24p. (WAL-401/103-22; Interim Technical Report 4)

WAL-401/105-16 3460
New York Univ.
GRAIN SIZE CONTROL IN TITANIUM AND THE EFFECT THEREON OF VARIOUS ADDITION AGENTS: FINAL REPORT. Y. C. Liu and Harold Margolin. Nov. 14, 1952. 58p. (WAL-401/105-16)

WAL-401/105-17 3461
New York Univ.
TITANIUM-RICH TERNARY PHASE DIAGRAMS OF TITANIUM WITH CHROMIUM AND CARBON, MANGANESE AND CARBON, CHROMIUM AND NITROGEN, MANGANESE AND NITROGEN: FINAL REPORT. E. Ence, W. Kirk, and H. Margolin. Oct. 30, 1952. 58p. (WAL-401/105-17)

NUCLEAR SCIENCE ABSTRACTS

Vol. 7 June 30, 1953 No. 12A

BIOLOGY AND MEDICINE

3295
Sloan-Kettering Inst. for Cancer Research
SEMI-ANNUAL REPORT. Feb. 1, 1952. 95p. (AECU-2463)

Separate abstracts have been prepared on two sections of this report. (C.H.)

3296
Sloan-Kettering Inst. for Cancer Research
PHYSICS AND BIOPHYSICS. p.1-51 of SEMI-ANNUAL REPORT. Feb. 1, 1952. 51p. (AECU-2463(p.1-51))

Improved techniques in the preparation of radioautographs, development of equipment for determining the mass of structural elements in biological specimens with soft x rays, and development of an optical density analyzer for use in radioautography, x-ray-absorption studies, ultraviolet microscopy, and isodosimetry are described. The respiratory pathway for radiocarbon excretion was studied following the administration of labeled Na acetate, methionine, polyvinylpyrrolidone, and dextran to patients; preliminary data are presented. The use of internal gas counting methods in the measurement of radioactivity in tracer experiments employing radioactive C and H is described; a precision better than 1% is reported. Biosynthetic methods are described for the preparation of adenine, guanine, cytosine, and uracil, with their nucleosides, all containing T. Preliminary studies of the quantitative significance of D and T as tracers for normal H are reported. The synthesis by exchange with radioactive water of high-activity adenine, sodium acetate, and methyl alcohol containing T are reported. Preliminary results are reported of the direct measurement with a windowless flush counter of T activity in solid samples. Excellent resolving power was observed in radioautographs from studies using T. Human-metabolism studies using C^{14}- and I^{131}-labeled compounds, H^3, radioactive Fe, Na, K, Cu^{64} and Co^{60}, and avian studies with radioactive Fe are summarized. Electron-microscopic demonstration of the effects of chemotherapeutic agents on the finer structures of the cell is reported. Development is reported of a new type of continuous counting rate meter for radiation detection and measurements, a scintillation detector for the external detection of γ rays from I^{131}, and a portable scintillation probe for monitoring radiation from Ra implants. (C.H.)

3297
Sloan-Kettering Inst. for Cancer Research
PROTEIN CHEMISTRY, IMMUNOCHEMISTRY, AND CLINICAL INVESTIGATION. p.52-95 of SEMI-ANNUAL REPORT. Feb. 1, 1952. 44p. (AECU-2463(p.52-95))

Preliminary tracer studies are reported on the organic and physicochemical aspects of nucleic acids and related compounds, including nucleic acid metabolism and turnover, structure of nucleic acids, isolation and characterization of the nucleoproteins of normal and leukemic mouse spleen, plasma proteins of patients with neoplastic disease, related high-molecular-weight substances, and antitissue antibodies. Studies on the capacity of various cancers of the thyroid to collect I^{131}, physiological changes occurring in man after isotopic administration of large amounts of radiation, and the optimal dose of I^{131} for treatment of hyperthyroidism are discussed briefly. The preparation of labeled pituitary hormones and development of chromatographic methods for their separation are reported. Data are presented from a quantitative comparison of the effects on the alkaline phosphatase activity of living mouse bone of equal doses of ionizing radiations of different qualities. (C.H.)

3298
McCollum-Pratt Inst., Johns Hopkins Univ.
THE BIOSYNTHESIS OF STABLE COBALTO-PROTEINS BY PLANTS. II. INTERACTION OF IRON AND COBALT METABOLISM IN NEUROSPORA CRASSA. Robert Ballentine. [1952]. 22p. (AECU-2518)

The essentiality of Co for growth in Neurospora crassa was investigated in a series of experiments employing length of growth, Co concentration, and Fe concentration as experimental parameters. Results indicate that the metabolism of Co by the organism pertains directly to this element and is not dependent on metabolism of Fe. (C.H.)

3299
Laboratory of Biochemistry, Univ. of Ill.
LACTOSE METABOLISM. 1. CARBOHYDRATE METABOLISM OF L. BULGARICUS STRAIN GERE A. W. J. Rutter and R. G. Hansen. [1952]. 24p. (AECU-2519)

An investigation is reported of metabolism by L. bulgaricus strain Gere A with particular reference to the metabolism of lactose and its constituent monosaccharides, glucose and galactose. Observations presented indicate that with this organism the ability of a cell to readily metabolize a sugar does not necessarily mean that the cell can utilize this sugar for growth. Data on growth characteristics and enzymatic factors are presented. (C.H.)

3300
Atomic Energy Project, Univ. of Calif., Los Angeles
COMPARATIVE EFFECTS OF HIGH EXPLOSIVE BLAST ON MECHANICALLY CONSTRAINED MICE AND RATS. B. Cassen, H. Gass, and K. Kistler. Issued Apr. 30, 1953. 11p. (UCLA-252)

Field tests were conducted by subjecting both mice and rats simultaneously to dorsally incident air blast while their feet were loosely taped or tied to $\frac{1}{4}$-in. thick steel plates. It was found that although the weights of the animals differed by a factor of about 10, the relative degree of pulmonary edema produced in the rats and mice at the same position was the same. Also, the pressure range producing lethality was the same for the two types of animals. (auth)

RADIATION EFFECTS

3301
Washington Univ. School of Medicine, St. Louis
EFFECT OF SUBLETHAL TOTAL BODY X-RADIATION ON SUSCEPTIBILITY OF MICE TO SALMONELLA ENTERITIDIS AND ESCHERICHIA COLI. I. L. Shechmeister, L. J. Paulissen, and M. Fishman. [1953]. 14p. (AECU-2520)

Mice were challenged intraperitoneally with S. enteritidis over a 30-day period following exposure to 50 to 350 r whole body x radiation. A very marked increase in susceptibility to infection was observed as early as 8 hr after irradiation with 250 to 350 r, but not after 50 r. This increase in sus-

ceptibility cannot be explained by granulocytopenia at the time of injection, since granulocytosis was observed in peripheral blood of mice at this post-irradiation period. A very marked increase in susceptibility to intraperitoneal inoculation with E. coli was observed one day following irradiation with 200 to 450 r. This gradually declined but was still evident 60 days after exposure to 450 r, and 11 days after exposure to 200 to 350 r. After exposure to 50 r, the single peak of susceptibility to E. coli occurred in 11 days. The relationship of the route of inoculation and the post-irradiation time to the degree of susceptibility to infection is discussed. (auth)

3302

New England Deaconess Hospital, Boston
THE EFFECTS OF IONIZING RADIATION, CERTAIN HORMONES, AND RADIOMIMETIC DRUGS ON THE DEVELOPING NERVOUS SYSTEM. Samuel P. Hicks, New England Deaconess Hospital, Boston and Harvard Medical School. [1953]. 31p. (AECU-2521)

The pathological effects of ionizing radiation on the developing nervous system in rats and mice was investigated and a timetable of radioinduced malformations is presented. Comparison is made with the production of malformations by anoxia, certain hormones, and radiomimetic drugs. Mechanisms involved in metabolic inhibition are discussed. A critical period in the metabolic sequence of development was observed in differentiating cells, such as the neuroblast in the nervous system and corresponding cells in other systems. It was concluded that the metabolic machinery for differential growth is intimately related to certain sulfhydryl enzymes, and these may be the common meeting ground for effects produced by such seemingly diverse agents as radiation, triethylene melamine, and certain steroids. (C.H.)

3303

Sedgwick Labs. of Sanitary Science, Mass. Inst. of Tech.
EFFECT OF BETA RADIATION UPON BIOCHEMICAL OXIDATION IN POLLUTED WATERS. Rolf T. Skrinde and Clair N. Sawyer. Sept. 30, 1952. 55p. (NYO-4438)

A study of the inhibitory effects of P^{32} upon waste purification by biochemical oxidation in natural and synthetic sewage is reported. Use of a Warburg apparatus for oxidation measurements is described. From results in full strength substrates it appears that the effect of P^{32} upon oxidation is of a rather erratic nature, being distinctly inhibitory to oxidation in synthetic sewage at concentrations of 60 and 80 mc/l while failing to show this effect in undiluted domestic sewage. (C.H.)

3304

Radiation Lab., Univ. of Calif., Berkeley
AN ELECTROPHYSIOLOGICAL STUDY OF SOME PROPERTIES OF THE VERTEBRATE RETINA (thesis). Leo E. Lipetz. Jan. 1953. 147p. (UCRL-2056)

A technique is described by which electrical impulses were picked up by micro-electrodes from single elements of frog retinas in response to stimulation of the retina. A method is described which allows study of the electrical responses to light of the frog retina in vitro for approximately two hours. A frog preparation was developed which permitted measurements for periods up to 10 hours of the electrical discharges of retinal ganglion cells, and responses observed are described. The electrical response at the optic nerve caused by changes in retinal illumination was measured and compared with actual energy absorbed at the photoreceptors. The retinal responses to light and to x radiation were compared and it was concluded that light and x radiation both excite the same retinal processes and in addition x radiation exerts a desensitizing action on some of the retinal photochemical processes. Production of phosphine in response to radiation is discussed. It is concluded that ionizing radiation may be a useful tool in the study of vision, since it affects processes which are essential to vision but unaffected by light. 137 references. (C.H.)

3305

Naval Radiological Defense Lab.
THE CAUSE OF INCREASED SUSCEPTIBILITY TO AVIRULENT PASTEURELLA PESTIS AFTER EXPOSURE TO A SUBLETHAL DOSE OF X IRRADIATION. M. S. Silverman, P. H. Chin, V. Greenman, and J. C. Young. Jan. 4, 1953. 17p. (USNRDL-389)

The cause of death of sublethally x-irradiated mice after injection with avirulent Pasteurella pestis was investigated. It was found that the increased mortality was due to an increased susceptibility of the irradiated mice to the plague endotoxin rather than to a lowered resistance which permitted the avirulent organism to multiply and invade the host. When the irradiated animals were injected with organisms killed with formalin which destroys the toxin, no increased number of deaths occurred. Heat-killed organisms in which the endotoxin is apparently intact were lethal to irradiated mice. The irradiated mice could be protected against death by challenge with the living organism when they were immunized with the plague toxin. Immunization with Fraction IA, the antibacterial antigen, did not protect the animals. (auth)

3306

DOSAGE MEASUREMENT OF THE BETA-RADIATION OF RADIOACTIVE ISOTOPES IN HOMOGENOUS SUBSTANCES. K. Sommermeyer. Translated from Z. Physik 133, 201-38 (1952). 20p. (AEC-TR-2019)

Questions associated with the dosimetry of β particles from radioisotopes used for therapy or tracer studies are discussed. (C.H.)

3307

EFFECT OF X-IRRADIATION ON FAT BALANCE AND ON LIPID AND VITAMIN A CONTENT OF THE LIVER. John G. Coniglio, William J. Darby, Mary Catlett Wilkerson, Richard Stewart, Anne Stockell, and Granville W. Hudson. Am. J. Physiol. 172, 86-92(1953) Jan.

Fat absorption in rats irradiated with doses of 500 or 650 r of x ray in one single dose was studied over a 28-day period by use of the balance method. No significant difference was observed between irradiated and pair-fed control animals in the amount of fat excreted during the postirradiation period as the percentage of ingested fat lost in the stools. In both irradiated and control rats a decrease was observed in the amount of fat excreted in the postirradiation period, a result probably due to the decreased food intake which occurred after irradiation. Studies of liver lipids in x-irradiated and pair-fed control animals at intervals from 2 to 42 days after irradiation revealed no significant change in total lipids, phospholipid, or total cholesterol directly attributable to the irradiation. No significant changes were observed in liver vitamin-A concentrations due to irradiation. The importance is emphasized of paired-feeding in studies of metabolic effects of irradiation. (auth)

3308

ROENTGEN-RAY CATARACT. EFFECTS OF SHIELDING OF THE LENS AND CILIARY BODY. A. J. Alter, and P. J. Leinfelder. Arch. Opthalmol. (Chicago) 49, 257-60(1953) March.

Exposure to roentgen rays does not cause cataract when the lens is protected by a lead shield 2 mm thick. The actively growing equatorial portion of the lens appears to be most sensitive to injury by roentgen rays. The pupillary zone of the lens appears to be the least sensitive. Exposure of one quadrant of the lens to roentgen rays results in opacities limited to that quadrant. (auth)

3309
A HISTOCHEMICAL STUDY OF NORMAL AND IRRADIATED SALIVARY GLAND TISSUE IN THE MOUSE. M. S. Burstone. Anat. Record 115, 543-57(1953) March.

The normal sublingual and submaxillary glands of immature mice contain periodic acid-Schiff (pa-S) positive material (glycoprotein) which is water soluble. The normal submaxillary gland components exhibit the greater water solubility. Irradiation from P^{32} results in a great decrease in stainability of the submaxillary gland alveoli as compared with the sublingual gland, and an increase in the water solubility of pa-S positive components of both glands. On the basis of this study the submaxillary gland exhibits a greater radiosensitivity than the sublingual gland. (auth)

3310
SOME OBSERVATIONS ON THE EFFECT OF GAMMA IRRADIATION ON THE BIOCHEMISTRY OF RABBIT BONE MARROW. John F. Thomson, Wallace W. Tourtellotte, Magdalene S. Carttar, and John B. Storer. Arch. Biochem. and Biophys. 42, 185-96(1953) Jan.

Exposure of one leg of rabbits to 310 or 620 r of Co^{60} γ rays produced a marked decrease in the concentration of ribo- and desoxyribonucleic acids in the exposed marrow in comparison with the control leg. The degree to which these changes occurred could be minimized by petreatment of the rabbit with phenylhydrazine. Separation of the marrow into its subcellular components revealed that although the total number of nuclei was decreased by radiation, the concentration of DNA per nucleus was unaltered. Little of the decrease in RNA occurred in the nucleus; per unit nitrogen, the mitochondria, particles, and supernatant showed progressively greater diminution of RNA phosphorus. These results could be best explained on the basis of a relatively selective elimination of cell types having high concentrations of cytoplasmic RNA, with a relative increase of cell types containing small amounts of RNA remaining after irradiation. (auth)

3311
THE BEHAVIOR OF AN X-RAY-INDUCED RING CHROMOSOME IN MAIZE. Drew Schwartz. Am. Naturalist 87, 19-25(1953) Jan.–Feb.

The behavior of an x-ray-induced ring chromosome in maize involving almost the whole of chromosome 6 is described. By crossing over in ring-rod heterozygotes and breakage of the resultant anaphase bridges, the ring is frequently converted into a rod chromosome. Some of the rods carry a duplication and are transformed back to rings in subsequent meiotic divisions. The inclusion of the nucleolar organizer in the anaphase bridge results in a high frequency of aberrant spore quartet types. (auth)

3312
EFFECT OF X RADIATION ON GAMETES OF PARACENTROTUS LIVIDUS MRTSN. IN THEIR EMBRYONIC AND LARVAL STAGES. I. Carlo Maxia and Giuseppe Deriu. Rass. med. sarda 3, 279-81(1952) Sept.–Oct. (In Italian)

Sea urchin eggs and spermatozoa were exposed to levels of x radiation from 50 to 200,000 r. Effects on fertility and development of the fertilized gamete are illustrated. 25 figures. (G.Y.)

3313
HISTOCHEMICAL INVESTIGATION OF ALKALINE PHOSPHATASE BEHAVIOR IN KIDNEY AND DUODENUM IN ADRENALECTOMIZED AND IRRADIATED RATS. Duccio Palazzi. Arch. "E. Maragliano" patol. e clin. 7, 821-36 (1952) Sept.–Oct. (In Italian)

Renal and duodenal alkaline phosphatase diminished slightly in adrenalectomized female rats; increased more or less markedly in proportion to the dose in rats whole-body irradiation with 750, 1500, or 3000 r of 170-kv x rays; and decreased very sharply in rats both adrenalectomized and 750-r whole-body irradiated. (G.Y.)

3314
CONTRIBUTION TO THE PROBLEM OF PROTECTIVE AGENTS AGAINST RADIATION EFFECTS. Kurt Erdmann. Naturwissenschaften 40, 147(1953) Feb. (In German)

Euglobulin solutions, with and without the addition of cysteine, ascorbic acid, NaN_3, gluthathione, or Na thioglycolate, were irradiated with ultraviolet or x rays. The protective agents prevented turbidity, even when the solutions were heated to 56°C following the irradiation. Whether this protective effect can be applied to the protein in cell nuclei was studied with Unio mussel eggs. Na thioglycolate prevented coagulation, whereas cysteine, thioglycolic acid, and ascorbic acid had no effect, presumably because they did not penetrate the nuclear membrane. (G.Y.)

3315
DEVELOPMENT OF BACTERIOPHAGE IN X-RAY INACTIVATED BACTERIA. Louis W. Labaw, Vernon M. Mosley, and Ralph W. G. Wyckoff. J. Bacteriol. 65, 330-36(1953) March.

Observations made on systems consisting of x-irradiated E. coli infected with bacteriophage show that bacteriophage grows better on x-irradiated than on ultraviolet-irradiated bacteria. Effects of the two types of radiation on metabolism of the bacteria are discussed. (C.H.)

3316
HEMATOLOGICAL DISTRUBANCES IN GUINEA PIGS BEARING A MALIGNANT TUMOR. P. Mendeleef. Compt. rend. soc. biol. 146, 1432-4(1952) Sept. (In French)

The additive action of methylcholanthrene and Ra produces in guinea pigs, weighing between 250 and 350 g, a reticulum sarcoma located at the point of injection of the methylcholanthrene. 400 r are applied to the right flank on a surface 30 × 18 mm and 2 cg of methylcholanthrene injected. The resultant malignancy causes modification of the cellular composition of the blood, general anemia with frequent intraperitoneal hemorrhages, and stimulation of the hematopoiesis of the spleen. Successive grafts of the tumor to healthy guinea pigs result in the same effects. (J.S.R.)

3317
INFLUENCE OF THE SUPRARENAL HORMONES UPON THE HEMATOPOIETIC REGENERATION OF THE IRRADIATED RAT. H. Betz. Compt. rend. soc. biol. 146, 1423-6(1952) Sept. (In French)

Rats receiving varying dosages of suprarenal hormones were exposed to sublethal radiation. The rats injected daily with desoxycorticosterone acetate showed no modification in the lymphoid regeneration. The myeloid regeneration was stimulated on the sixth and seventh day after irradiation. Centers of erythropoiesis appeared in the liver. Rats injected daily with 5 mg of cortisone showed no effect on the regeneration of the lymphatic and myeloid organs, but the regeneration of the thymus was completely stopped. The lymphoid and myeloid regeneration in rats receiving 10 mg of cortisone daily was almost entirely blocked. (J.S.R.)

3318
NATURE OF THORIUM-X ACTION ON HUMAN SKIN. Victor H. Witten and Marion B. Sulzberger. Hautarzt, Der 3, 521-7 (1952) Nov. (In German)

In addition to the direct effect of the radiation of ThX (Ra^{224}) and its decay products on the surface of the skin, internal radiation effects result from penetration of the radioactive atoms in four different ways: diffusion of thoron, penetration of the vehicle (e.g., alcohol) in which the ThX is incorporated, penetration of ThX-bearing H_2O separated from the vehicle, and penetration by means of sweat and sebacious matter. The effects of the radiations are illustrated. (G.Y.)

3319
THE EFFECT OF HIGH INTENSITY ELECTRON BURSTS ON ANTIBODIES. Frederick B. Traub, Arno Brasch, and Wolfgang Huber. J. Immunol. 70, 366-71(1953) April.

Antibodies were irradiated with high-intensity electron bursts under varying conditions of environment. Differences in radiation sensitivity according to species origin are described. Observed changes could not be correlated with molecular weight, state of purification and the concentration of the antibody in serum. A dose-temperature dependence has been demonstrated and a possible explanation for this phenomenon is discussed. Effect of dilution on the radiation-inactivation of antibodies has been investigated and its significance evaluated. The results are discussed in relation to the target theory of radiation inactivation. (auth)

3320
THE EFFECTS OF SPLEEN SHIELDING AND SUBSEQUENT SPLENECTOMY UPON ANTIBODY FORMATION IN RATS RECEIVING TOTAL-BODY X-IRRADIATION. R. W. Wissler, M. J. Robson, F. Fitch, W. Nelson, and L. O. Jacobson. J. Immunol. 70, 379-85(1953) April.

Lead shielding of the spleen during total-body x irradiation was found to largely abolish the depressant effect of x irradiation upon circulating antibody formation in the rat whether a particulate antigen was given intravenously or intraperitoneally. The action of the x radiation was reversed whether the antigen was given prior to total-body x irradiation or 24 or 48 hours afterward. Splenectomy by itself largely suppressed the appearance of circulating antibody in the rat whether the antigen was given 24 hours before, or just prior to, or 24 hours after removal of the spleen. No such effect of splenectomy was apparent when the antigen was given intraperitoneally. (C.H.)

3321
EFFECTS OF X-RAYS ON THE FORMATION OF LACTASE IN A LYSOGENIC STRAIN AND SENSITIVE STRAIN OF ESCHERICHIA COLI. Charles Yanofsky. J. Bact. 65, 383-7(1953) April.

The effects of x rays on the adaptive formation of lactase in two strains of E. coli were investigated. It was found that x-ray doses which have a marked effect on the viability of the two strains have only a slight effect on their ability to form lactase adaptively. One of the strains studied, K-12, releases lactase into the suspending medium when it is incubated with lactose following irradiation. The release of lactase into the suspending medium was shown to be due to the lysis of cells in which the production of phage was induced by irradiation. The appearance of appreciable lactase activity in the suspending medium of irradiated K-12 cells incubated with lactose indicates that lactase was formed in the cells which lysed and liberated phage. All the evidence obtained is consistent with the view that the formation of lactase and lysogenic phage production can occur simultaneously in the same cells. (auth)

3322
DIFFERENTIATION AS A DETERMINANT OF THE REACTION OF RAT EMBRYOS TO X-IRRADIATION. James G. Wilson, Robert L. Brent, and H. Charles Jordan. Proc. Soc. Exptl. Biol. Med. 82, 67-70(1953) Jan.

X irradiation of rat embryos on the 8th day of gestation had a more limited effect on subsequent development than did similar treatment on the 9th or 10th days. The only residual effect after doses of $12\frac{1}{2}$ to 100 r on the 8th day was retardation of growth. Exposure to comparable doses on the 9th and 10th days has been shown previously to result in the development of malformations and in an increase in mortality, as well as in retardation of growth. This difference in reactivity appears to be dependent upon whether cellular differentiation within the embryos has begun at the time of irradiation. (auth)

RADIATION HAZARDS AND PROTECTION

3323
Army Medical Research Lab., Fort Knox
THE RADIOACTIVITY OF THE NORMAL HUMAN BODY, A CONTRIBUTION TO THE PRESENT SITUATION. A. T. Krebs. Jan. 12, 1953. 14p. (AMRL-109)

The latest value for the basal radioactivity of the human body (average value according to Sievert 1.03×10^{-8} g of γ radiation Ra equivalent) is discussed in connection with earlier findings and also an estimation of permissible high-intensity, short-period total-body exposures and low-intensity, long-period total-body irradiations. Recent developments show that the problem of basal radioactivity of the human body is more complicated than anticipated. Using the latest value in connection with figures from investigations on uranium miners and the data known from Ra poisoning cases an estimation of permissible total-body exposures may be made by applying as a first approach the intensity x time law. (auth)

3324
Los Alamos Scientific Lab.
STUDIES ON THE MECHANISM OF ACTION OF THERMAL NEUTRONS IN PRODUCING BIOLOGICAL EFFECTS. I. LACK OF EFFECT OF HYPOXIA AND GLUTATHIONE IN ALTERING MORTALITY IN MICE. John B. Storer, L. Edward Ellinwood, Wright H. Langham, and Phyllis Sanders. Mar. 1953. 24p. (LA-1527)

Pretreatment of mice with p-aminopropiophenone (an agent producing pronounced hypoxia) or glutathione exerted a marked protective effect against total-body x radiation. A negligible degree of protection was found when mice so pretreated were exposed to thermal column radiation (thermal neutrons plus γ contaminant). It is tentatively suggested that the lack of effect of these agents against thermal column exposure results from the fact that the majority of the ionizations are produced along a short track and that under these conditions certain products produced by the ionization of H_2O can be formed independently of molecular O. On the basis of the data reported it appears that agents which are protective against one type of ionizing radiation may not be of value against all types and that tissue O tension may play a role in producing the marked differences observed in the relative effectiveness of neutrons and x rays in various tissues. (auth)

3325
Sedgwick Labs. of Sanitary Science, Mass. Inst. of Tech.
ASSAYING TECHNIQUES FOR RADIOISOTOPIC CONTAMINANTS IN WATER SUPPLIES. A. Gordon Wheler, Jr., Warren J. Kaufman, and Rolf Eliassen. July 1, 1952. 73p. (NYO-4437)

Methods are described for determining the types and amount of radiation from radioactive isotopes which may be found in water supplies. Discussions of theoretical considerations, instrumentation, experimental procedures and results, and a standardized method of assaying water supplies for β activity are included. (C.H.)

3326
New York Operations Office, AEC
RADIOACTIVE CONTAMINATION SAMPLING BY SMEARS AND ADHESIVE DISCS. Eugene V. Barry and Leonard R. Solon. May 1953. 10p. (NYO-4524)

Filter paper smears and adhesive disks were used to remove surface material from U sheets, these sheets regarded as sources of uniform radioactive contamination. The smear technique yielded substantially more reproducible results than the adhesive sampling. (auth)

3327
Oak Ridge National Lab.
HEALTH PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 20, 1953.

Issued Mar. 30, 1953. 17p. (ORNL-1488)

The average number of ev necessary to form an ion pair was determined to be 46 for He, 37 for H, and 34.3 for CO_2. Preliminary data from studies to determine the maximum reasonable amount of filtration of x ray beams to be used at each applied voltage are reported. Problems associated with modification of film dosimeters for fast-neutron dosimetry, and results obtained using a radiator consisting of layers of Al foil and paper, are discussed. Tests are reported of a high-speed air top which produced aerosol droplets of dicatyl phthalate as small as 15 μ in diameter and having a uniformity of ±10%. Preliminary results of studies on the removal of Ba^{140}, La^{140}, Cr^{51}, Sr^{89}, Y^{91}, Sc^{46}, and W^{185} from water by means of coagulation and alum, adsorption on natural clays, water softening procedures, phosphate coagulation, and removal by various materials in small glass columns are tabulated. Preliminary results of a study of the uptake of Cs^{137} and Sr^{89} by fish from contaminated water at temperatures ranging from 4 to 29°C show the concentration of radioactivity in the fish increased with the temperature of the water. Among fish treated identically, a wide variation in radioactivity was found. The counting response to γ radiation was determined for a crystal spectrometer to be used as an analytical instrument to identify γ-emitting isotopes and determine the amount of each such isotope in water containing radioactive waste. (C.H.)

3328

PROTECTIVE ACTION OF β-MERCAPTOETHYLAMINE IN THE CASE OF RATS IRRADIATED IN TOTO. G. Lambert, J. Maisin, and M. Mandart. Compt. rend. soc. biol. 146, 1434-5(1952) Sept. (In French)

Rats, immediately before exposure to 700 r of x rays, received intraperitoneally 15 mg of 2-mercaptoethylamine dissolved in sufficient HCl for neutralization. The 2-mercaptoethylamine lowered the mortality rate, delayed death, and raised the lethal dose. (J.S.R.)

RADIATION SICKNESS

3329

School of Aviation Medicine

BONE MARROW IMPLANTS IN THE TREATMENT OF RADIATION SICKNESS. John M. Talbot and Herbert B. Gerstner. Sept. 1951. 16p. (ATI-116834)

3330

RADIATION SICKNESS; A MEDICAL SURVEY OF THE IMMEDIATE EFFECTS ON THE VICTIMS OF THE NAGASAKI A-BOMBING. Masao Shiotsuki. Oriental Economist 21, 30-4(1953) Jan.

A vivid, first-hand account of the dropping of the atomic bomb on Nagasaki, and the immediate clinical symptons and anatomical observations made by a very acute observer on survivors is presented. Pathological observations on 2000 patients treated during the first month following the explosion are summarized. (C.H.)

RADIOGRAPHY

3331

Atomic Energy Research Establishment, Harwell, Berks (England)

A COMPARISON OF RADIOGRAPHIC TECHNIQUES WITH SPECIAL REFERENCE TO DOSAGE. G. M. Ardran and H. E. Crooks. Jan. 19, 1953. 10p. (AERE-Med/R-1101)

Radiographic techniques are described which produce films of satisfactory quality with considerably reduced radiation dose to the patient. These techniques are compared with those generally used. (auth)

RADIOTHERAPY

3332

LYMPHATIC DRAINAGE FOLLOWING INTRABRONCHIAL INSTILLATION OF SILVER-COATED RADIOACTIVE GOLD COLLOIDS IN THERAPEUTIC QUANTITIES. P. F. Hahn and E. L. Carothers. J. Thoracic Surg. 25, 265-79(1953) Mar.

The distribution of silver-coated radioactive colloidal Au particles, following their intrabronchial administration in dogs, has been studied at levels of radioactivity which are estimated to be in a therapeutic range for treatment of metastatic lesions in bronchiogenic tumors. A short series of experiments in which the Ag coat as well as the Au nucleus were radioactive indicates that the Ag coat is gradually leached off in the lung and is carried to the liver for ultimate secretion, probably by the biliary tract. It is found that the Ag assists in the transport of the radioactive Au nucleus by way of the lymphatics to the thoracic nodes thus facilitating irradiation of these common sites of metastatic processes. Estimated roentgen equivalent dosages to various tissues of interest would suggest that the amount of irradiation encountered by the liver is well within tolerable limits by a factor of perhaps 10 times. Dosages to the lung into which the material was introduced are relatively high but this tissue is considered expendable since in most cases pneumonectomy is planned when treatment is anticipated. Dosages to the lymph nodes are estimated to be of the order of several hundred thousands equivalent β roentgens. It is felt that discrepancies in uniformity of distribution in such tissues would be well taken care of by the large factor of safety over estimated cancericidal doses necessary to deal with metastatic processes. The possibility of obstruction in the cases of metastatic tumor involving lymphatic channels is considered. Also the possibility of collateral lymphatic drainage under such conditions is hypothecated. study of drainage by the lymph nodes in cases of bronchiogenic tumor in human beings is obviously necessary before the distribution of radiation can be depended upon as a therapeutic procedure. (auth)

3333

STUDY OF THE RATE OF TRANSMISSION OF X RAYS AT THE LEVEL OF THE MAMMARY GLAND AND AXILLA WITH THE AID OF SIEVERT MICROCHAMBERS. A. Ennuyer, M. Bertoluzzi, F. Folichon, and P. Chardier. J. radiol. et électrol. 33, 526-36(1952). (In French)

The spatial dose distribution of x rays in a paraffin phantom of shape approximating that of the breast was studied with inserted micro ionization chambers. Also studied were the rate of x-ray transmission through excised tissues, loss of dose by escape of radiation during breast irradiation, and rate of transmission in the axilla during an anterior subclavicular irradiation. (G.Y.)

3334

PATHOLOGICAL CHANGES FOLLOWING INTRACAVITARY THERAPY WITH COLLOIDAL Au^{198}. Ralph M. Kniseley and Gould A. Andrews. Cancer 6, 303-12(1953) March.

Twelve patients with advanced cancer, who were treated with colloidal Au^{198} for relief of effusions, were studied at autopsy, and the findings are reported. The colloidal Au^{198} is adsorbed on the cavity surfaces where it precipitates in the form of relatively large aggregates and is phagocytosed. Frequently, fibrous thickening of the pleura or peritoneum is found, usually without extensive adhesions. Radiation damage to the tumor was not prominent and was limited to very superficial zones. Morphological evidence of whole-body radiation was minimal. (auth)

3335

EXPERIENCES IN THE CLINICAL APPLICATION OF RADIOACTIVE PHOSPHORUS. F. Odenthal and K. Philipp.

Munch. med. Wochschr. 47, 2363-70(1952) Nov. 21. (In German)

Therapy of several cases of polycythemia vera and chronic myeloid leukemia with P^{32} is reviewed briefly. Changes in the blood picture during treatment are illustrated by graphs. (G.Y.)

3336

EXPERIMENTS WITH INTERCAVERNOUS ROENTGEN IRRADIATION AND SO-CALLED COLLIMATOR GRIDS. M. Sangster. Acta. Radiol. 39, 57-63(1953) Jan.

Possibilities of improving dose distribution in the parametrium in more advanced cases of carcinoma portio uteri by intercavernous irradiation via the vagina are discussed. A new type of applicator is described, based on utilization of the scattered radiation of a primary bundle of roentgen rays and on the use of a collimator grid. The results of phantom determinations made on this applicator are given. The action of a collimator grid is elucidated by an optic model and the insight gained is further increased by means of calculations. Mention is made of investigations now being made into the use of γ-ray applicators. (auth)

TOXICOLOGY STUDIES

3337

AGENTS DIMINISHING SKELETAL ACCUMULATION OF LEAD. Norman S. MacDonald, Florita Ezmirlian, Patricia Spain, and Donald E. Rounds. Arch. Ind. Hyg. and Occupational Med. 7, 217-20(1953) Mar.

A search for readily available chemical agents suitable for intravenous administration which might be of use in the therapy of poisoning by metals which accumulate in bone was carried out. Young rats received intravenous injections of lead acetate, followed one-half hour later by an injection of the chemical agent. After one day, the femurs and livers of the killed animals were removed and ashed and analyzed for lead. The same chemical agents were also tested by administration one-half hour before the rats received the lead injection. The materials tested were the tetrasodium salt of EDTA, casein hydrolysate, pectin, a copolymer of methylvinyl ether and maleic anhydride, glucuronolactone, oxypolygelatin, polyvinylpyrrolidone, dextran, sodium thiosulfate, and a hydrolyzed polyacrylonitrile. The first four agents significantly reduced the bone burden of lead and the first seven agents showed enough promise to merit detailed clinical evaluation for human usage. The liver burden of lead also tended to decrease in those animals in which the bone burden was lowered. (auth)

TRACER APPLICATIONS

3338

Georgetown Univ. Medical Center

DYNAMICS OF CALCIUM METABOLISM. I. TIME DISTRIBUTION OF INTRAVENOUSLY ADMINISTERED RADIOCALCIUM. R. O. Thomas, T. A. Litovitz, M. I. Rubin, and C. F. Geschickter. [1951]. 24p. (AECU-2457)

The disappearance from the blood, the uptake by the bones, and the excretion via the urine and feces of tracer radiocalcium have been investigated for groups of normal young and adult rabbits. Mathematical analysis of the blood disappearance curves obtained in this study indicated that four exponential terms are needed to represent the data. From the first two terms the rates of exchange of Ca between plasma and extravascular compartments were calculated and shown to be in good agreement with data previously obtained by others for other ions. Within the experimental accuracy these above rates were found to be the same in both young and adult rabbits. The third term in the blood disappearance equation has been correlated with the bone uptake of Ca. The bone uptake of radiocalcium in the young age group was greater than in the adult age group. Therefore, it has been shown that the third blood terms for the disappearance of Ca is a measure of bone activity. The fourth term from the equations expressing blood disappearance rates has been correlated with the excretion of Ca via the urine and feces. This excretory output has been found to be an inverse function of the bone uptake of Ca. From this study it was deduced that a mathematical analysis of blood disappearance data and excretion data for Ca can yield information regarding bone activity. (auth)

3339

Institute for the Study of Rate Processes, Univ. of Utah

PHOTOSYNTHESIS, A REVIEW; STUDIES OF PHOTOSYNTHETIC PROCESSES. Rufus Lumry, John D. Spikes, and Henry Eyring. Feb. 1, 1953. 35p. (AECU-2512; Technical Report 8)

Current research in the processes of photosynthesis are reviewed with special emphasis on the photochemistry of pigments, chloroplast structure, energy transfer mechanisms, the Hill reaction, and CO_2 fixation. (C.H.)

3340

Wisconsin Univ.

HOST RESPONSES ASSOCIATED WITH THE DEVELOPMENT OF OAK WILT. C. H. Beckman, J. E. Kuntz, A. J. Riker, and J. G. Berbee. [1952]. 24p. (AECU-2516)

Factors associated with the sudden wilting and death of oak trees soon after infection with the wilt fungus were investigated by observing the movement of radioactive Rb in the transpiration stream. Results following mechanical reduction of the water-carrying capacity of the xylem, by girdling, indicated that a reduction in capacity comparable to that found in infected oaks was capable of inducing similar wilt and death of fungus-free trees. (C.H.)

3341

McCollum-Pratt Inst., Johns Hopkins Univ.

RADIO-ASSAY OF COBALT-60. Robert Ballentine and Dorothy D. Burford. [1952]. 29p. (AECU-2517)

A radio-assay procedure for Co^{60} is described which involves a perchloric acid wet-ashing of biological samples, separation of the Co as cobaltic hydroxide, and electroplating from a K fluoborate buffer. Plating vessels to take maximum advantage of methane-flow proportional counting with a minimizing of self-absorption are described. A counter adapted to these cylindrical vessels is diagramed. A consideration of the various factors determining the choice of conditions is presented. The over-all error of the method is ±3%. (auth)

3342

Michigan State Coll.

RADIOISOTOPES IN RESEARCH ON NUTRITION OF FRUIT CROPS. S. H. Wittwer and H. B. Tuckey. [1953]. 25p. (AECU-2522)

The merits of using radioactive isotopes in tracer studies of plant nutrition are reviewed with special emphasis on their use in studies on fruit crops. Suggested studies include the nutritional aspects of stock-scion relationships in fruit crops, runner-plant development in strawberries, and the translocation and redistribution of mineral nutrients and elaborated food reserves in the tree fruits. (38 references). (C.H.)

3343

Lankenau Hospital Research Inst., Philadelphia

A STUDY OF ACETATE METABOLISM AND FATTY ACID SYNTHESIS IN LIVER SLICES OF HYPERTHYROID RATS. Morris A. Spirtes, Grace Medes, and Sidney Weinhouse. Lankenau Hospital Research Inst., Philadelphia and Institute for Cancer Research, Philadelphia. [1952]. 19p. (AECU-2530)

The metabolism of methyl-C^{14}-labeled acetate in liver

slices of normal and hyperthyroid rats was investigated. In rats made hyperthyroid by feeding of dried thyroid or by thyroxine injection, and prefed with a high-carbohydrate low-fat diet, liver slices showed approximately a 70% rise in acetate oxidation, no significant change in acetoacetate formation an an undiminished incorporation into fatty acids when compared with liver slices from normal rats. In liver slices of fasted thyroid-fed or thyroxin-injected rats, incorporation of acetate into fatty acids was of the same low range as is displayed by slices from fasted normal rats, but oxygen consumption and acetate oxidation were not diminished by fasting. In the hyperthyroid rat, no direct relationship was found between hepatic lipogenesis and glycogen levels. (auth)

3344

Texas Agricultural Experiment Station
DIHYDROXYACETONE ESTERS AS PRECURSORS OF TRIGLYCERIDES DURING INTESTINAL ABSORPTION. Raymond Reiser and Mary Carr Williams. [1952]. 10p. (ORO-92)

1-Palmitoxy-3-hydroxyacetone and monopalmitin, labeled with C^{14}, were synthesized and fed to rats. Analyses of the lipides of the thoracic duct lymph demonstrated that esterification of dihydroxyacetone with fatty acid and subsequent reduction and esterification may be the normal mechanism of triglyceride synthesis during fatty acid absorption. Hydrolyses of monoglycerides and synthesis of triglycerides probably takes place in the intestinal mucosa. (auth)

3345

USE OF COLLOIDAL Au^{198} FOR OBTAINING SCINTIGRAMS OF THE LIVER. Eric T. Yuhl, Lloyd A. Stirrett, and Benedict Cassen. Nucleonics 11, No. 4, 54, 56(1953) Apr.

Cats and rabbits were anesthetized with nembutal, and a single intravenous injection of Au^{198} was administered to each. A scintiscanner was set to scan the entire thorax and abdomen, with scanning beginning immediately after the injection. It was observed that at least 25 μc per kg of body weight was necessary to obtain a satisfactory outline of the liver, the delineation becoming increasingly sharp as the dose was increased. The Au^{198} appeared in the liver within one to two minutes after injection and reached its maximum concentration one hour later. The major portion of radioactivity was observed in the liver, the remainder appearing in the lungs. Scintigrams are shown for a 250-μc dose 19 hours after injection, and for 500-μc doses 1 and 19 hours after. (L.M.T.)

3346

THE DEPOSITION OF ^{91}Y IN RABBIT BONES. Barbara Rayner, Margaret Tutt, and Janet Vaughan. Brit. J. Exptl. Path. 34, 138-45(1953) April.

Chemical and radioautographic studies show that the deposition of Y^{91} in the bones of rabbits of different ages following a single intravenous injection of a carrier-free tracer dose is extremely rapid. Retention is greater, rather more persistent and less affected by age than that of Sr. Excretion in both urine and feces is rather less than that of Sr. Y^{91} appears to be concentrated in the site of active bone growth beneath the epiphysis but not beneath the endosteum or periosteum, suggesting differences in the character of the connective tissue of bone in the two sites and, in a patchy way in the shaft presumably in association with the connective tissue around blood-vessels. New bone in young animals formed months after the original injection contains traces of Y^{91}, presumably due to the capacity of some element in bone to complex with Y^{91} present in extremely low levels in the blood as a result of normal processes of resorption. (auth)

CHEMISTRY

3347

Radiation Lab., Univ. of Calif., Berkeley
THE HEAT OF FORMATION OF THORIUM SESQUISULFIDE. LeRoy Eyring and Edgar F. Westrum, Jr. Apr. 7, 1953. Decl. May 4, 1953. 7p. (AECD-3519; UCRL-2175)

The heat of solution of Th sesquisulfide was determined in 6.000M HCl at 25°C to ascertain the stability of the Th(III) halides. The molal heat of formation of Th_2S_3 from rhombic sulfur and crystalline Th is calculated as 258.6 kcal. (auth)

3348

Laboratory for Nuclear Science, Mass. Inst. of Tech.
NUCLEAR CHEMISTRY (INORGANIC) GROUP and NUCLEAR CHEMISTRY (ORGANIC) GROUP. C. D. Coryell, J. W. Irvine, Jr., and J. D. Roberts. p.23-34 of PROGRESS REPORT [FOR THE PERIOD NOVEMBER 30, 1952 TO FEBRUARY 28, 1953]. Feb. 28, 1953. 12p. (AECU-2494(p.23-34))

Progress is briefly reported on the following studies: extraction of Ga(III) from aqueous HCl by β,β′-dichlorodiethyl ether, extraction coefficient of Ge(IV) between aqueous HCl and tributyl phosphate, decay properties of Mo^{101}, Tc^{101}, Mo^{102}, and Tc^{102}, and carbonium ion rearrangements. (L.T.W.)

3349

Ames Lab.
THE REACTION BETWEEN CALCIUM METAL AND WATER VAPOR. [PART] I. Harry J. Svec and Dale S. Gibbs. [Mar. 30, 1953]. 9p. (ISC-325)

The reaction between Ca and water vapor has been studied in the temperature range 177 to 344°C. The data obtained in these studies show that the equation $2\ Ca + H_2O = CaH_2 + CaO$ characterizes the stoichiometry as long as Ca metal is present. When the Ca has been consumed, a second reaction takes place between CaH_2 and water vapor according to the equation $CaH_2 + 2H_2O = Ca(OH)_2 + 2H_2$. At temperatures below 80°C Ca metal reacts with water vapor or liquid water according to the equation $Ca + 2H_2O = Ca(OH)_2 + H_2$. (auth)

3350

Carbide and Carbon Chemicals Co. (Y-12)
SELECTED PROPERTIES OF 2-FURALDEHYDE: A LITERATURE SEARCH. Frances L. Sachs. Apr. 9, 1953. 28p. (Y-951)

This is a bibliography compiled from open and report literature on the chemical, physical, and mechanical properties of 2-furaldehyde. 68 titles with abstracts are listed. (J.S.R.)

3351

INFORMATION CONCERNING THE ORTHOSALTS OF OXYGEN ACIDS III. THE SYSTEM $Na-H_2-NaOH-Na_2O$. A. Klemenc and E. Svetlik. Translated by Mary E. Lee from Z. anorg. u. allgem. Chem. 269, 153-64(1952). 14p. (CF-53-1-219)

The system $Na-H_2-NaOH-Na_2O$ was investigated at the temperatures 444, 377, and 351°C as a possible method for the preparation of pure Na_2O. Reproducible heterogeneous equilibria are found in this system. The reaction reaches equilibrium in the two-phase region as a result of regulated H_2 pressure; thus the composition of the liquid phase can be determined. In this way the constant H_2 pressures in the three-phase regions at the indicated temperatures were determined. One method for the determination of the NaH content is given. The reduction of Na_2O begins at 110°C. (auth)

3352

INFORMATION CONCERNING A BERYLLIUM HYDRIDE, BeH_2. Egon Wiberg and Richard Bauer. Translated by Mary E. Lee from Z. Naturforsch. 6b, 171(1951). 3p. (AEC-TR-2017; CF-53-3-271)

The composition of $Be(AlH_4)_2$, formed from $BeCl_2$ and an ether solution of $LiAlH_4$, corresponds to the formulas of the homologous compounds $Be(BH_4)_2$, $Mg(BH_4)_2$ and $Mg(AlH_4)_2$. An ether solution of $BeCl_2$ in the presence of excess LiH precipitates a white compound which may be either BeH_2 on Li_nBeH_{2+n}. This reaction is analogous to that of $MgCl_2$ with excess LiH. (J.S.R.)

3353

THERMODYNAMICS ACTIVITY AND MISCIBILITY GAP. M. Maurice Rey. Translated from Compt. rend. 228, 545-7(1949). 3p. (AEC-TR-2023)

3354

Illinois Univ. Engineering Experiment Station

BIBLIOGRAPHY OF ELECTRO-ORGANIC CHEMISTRY; PART I. Sherlock Swann, Jr. 114p. (NP-4538)

A bibliography including reports, books, articles and unpublished dissertations on the application of electrolytic methods to the synthesis of organic compounds is presented. (J.E.D.)

3355

A NEW HIGHLY-SPECIFIC SPOT TEST FOR THE DETECTION OF ALUMINUM. L. M. Kulberg and I. S. Mustafin. Translated by Erich W. Stenzel from Doklady Akad. Nauk S.S.S.R. 77, 285-8(1951). 6p. (AEC-TR-2020)

3356

THE CRYSTAL STRUCTURE AND SUPERCONDUCTIVITY OF LANTHANUM. W. T. Ziegler, R. A. Young, and A. L. Floyd, Jr. J. Am. Chem. Soc. 75, 1215-21(1953) Mar. 5.

The crystal structure of La has been studied by powder x-ray-diffraction techniques at room temperature and the existence of the hexagonal close-packed (h.c.p.) and face-centered cubic (f.c.c.) modifications confirmed. The rate of interconversion of these crystal forms has been found to be slow. However, it has been shown that the f.c.c. modification can readily be converted to the h.c.p. structure at room temperature by severe deformation such as results when filings are produced from a massive specimen. The crystal structure of La filings in the h.c.p. form was not affected by cooling to liquid He temperatures; the same result (with one possible exception) was noted with filings having the f.c.c. structure. Six different samples of La have been examined for superconductivity by a magnetic method. It was found that the bulk specimens cut from the six samples in the as-received state each exhibited a transition into superconductivity in the range 3.1 to 5.45°K. Heat treatment for four days at 350° raised the transition temperature of very nearly 5.4°K. From x-ray-diffraction studies made of the bulk specimens, together with studies made on filings, it was concluded that both the f.c.c. and h.c.p. modifications of La are superconductors, the f.c.c. modification having a transition temperature near 5.4°K, while the h.c.p. modification (in a strained state) has a transition temperature of 3.9°K or greater. (auth)

3357

THE SOLUBILITY OF CARBON AND OXYGEN IN LIQUID BISMUTH. C. B. Griffith and M. W. Mallett. J. Am. Chem. Soc. 75, 1832-4(1953) Apr. 20.

Analytical methods for determining C and O in Bi are described. Using these methods, the solubility limits of O (400 to 750°) in liquid Bi were determined. The solubility of O in liquid Bi varies with temperature according to the equation, $\log_{10}$ wt.% $= -(3400/T) + 1.48$. An equation for the variation of liquid solubility of C in Bi with temperature is $\log_{10}$ wt.% C $= -(360/T) - 3.17$. (auth)

ANALYTICAL PROCEDURES

3358

Atomic Energy Research Establishment, Harwell, Berks (England)

THE ANALYSIS OF URANIUM-GALLIUM ALLOYS. G. W. C. Milner and A. J. Wood. Nov. 5, 1952. 16p. (AERE-C/R-1041)

A satisfactory procedure is described for the analysis of U-Ga alloys containing from 1 to 99% Ga. It is based on the initial separation of the Ga from U by the extraction of Ga chloride with ether. After the evaporation of ether from the combined organic extracts, the Ga is precipitated as Ga camphorate and finally determined by filtering on a sintered glass crucible, drying at 110°C and weighing. After the removal of dissolved ether from the aqueous solution by boiling, the U is precipitated as ammonium diuranate and finally ignited to U_3O_8. Trace amounts of U extracted with the Ga are determined absorptiometrically. (auth)

3359

Chemical Inspectorate, Ministry of Supply, London (England)

DETERMINATION OF MICROGRAM AMOUNTS OF BERYLLIUM USING ACETYL ACETONE. J. A. Adam, E. Booth, and J. D. H. Strickland. [Feb. 1952]. 15p. (ATI-164576; CI/R-52)

Acetyl acetone is first used to isolate the Be after interfering elements have been complexed with EDTA. The Be is then determined absorptiometrically as the acetyl acetone complex using radiation of wavelength 2950 A. The method will detect 0.25 μg of Be with certainty and determine large amounts with a precision of about ±5%. (auth)

3360

Knolls Atomic Power Lab.

THE QUANTITATIVE DETERMINATION OF PPM OF OXYGEN IN GASES. L. P. Pepkowitz and E. L. Shirley. Dec. 1, 1952. 24p. (KAPL-857)

An accurate and sensitive method for the determination of O in the range below 100 ppm is given. The method described is based on the Winkler manganous hydroxide reaction. The method is absolute with a zero blank. The standard deviation for precision is ±0.77 ppm of O and the sensitivity is 0.5 ppm. Relatively small samples can be handled since the reactions can take place below atmospheric pressure. This fact eliminates the need for a carrier gas, thereby removing one of the major sources of error. The apparatus is constructed of readily available laboratory equipment and can be made portable. Six to eight samples can be handled during the working day. (auth)

3361

Armour Research Foundation

QUANTITATIVE SPECTROGRAPHIC ANALYSIS FOR OXYGEN IN TITANIUM METAL; FINAL TECHNICAL REPORT. K. L. Yudowitch. July 25, 1952. 39p. (NP-4486)

An investigation was undertaken to test the feasibility of oxygen determination in Ti. Preliminary experiments revealed the presence of several spectral bandheads of titanium oxide which might be used as a measure of O content. The results of a series of tests on both pure and alloyed Ti indicated sensitivity to about 1% O. As the amounts of O of interest extended below this limit of detection, the feasibility test was considered to yield a negative result for immediate practical purposes. (J.E.D.)

3362

ELECTROCHEMICAL METHOD FOR OXYGEN DETERMINATION IN GASES. M. G. Jacobson. Anal. Chem. 25, 586-91(1953) Apr.

The depolarization by gaseous O of a C cathode polarized

in a galvanic cell showed promise for the development of a method for the measurement of O concentrations in gas mixtures. A study of this effect was made which resulted in the establishment of the basic theoretical concepts and experimental requirements that are important for the use of such electrodes as measuring elements. A brief outline of these concepts and requirements is given. On the basis of these results, a portable and a continuous O indicator were developed. The latest improved version of the continuous O indicator is described in detail as to construction, operation, performance, and maintenance. The instrument is produced in ranges from 0 to 1% to 0 to 25% O, is capable of an accuracy of 2% of full scale range, and is unaffected by CO and up to 24% CO_2. It is easily operated by unskilled personnel, and requires very little maintenance. (auth)

3363

SPECTROPHOTOMETRIC DETERMINATION OF BISMUTH, LEAD, AND THALLIUM WITH HYDROCHLORIC ACID. Charles Merritt, Jr., H. M. Hershenson, and L. B. Rogers. Anal. Chem. 25, 572-7(1953) Apr.

The fact that halide complexes absorbed in the ultraviolet suggested that it should be possible to devise a simple sensitive procedure for the determination of certain heavy metals in mixtures. A comparison of the spectra for chloride, bromide, and iodide complexes of bismuth, lead, and thallium indicated that the separation of absorption maxima is greatest in chloride solutions with only a slight loss in sensitivity for each element compared to that in iodide solutions. The effects of changes in concentration of acid and halide and the reproducibility of the absorbency measurements have been studied for bismuth, lead, and thallium and a procedure for their simultaneous determination has been worked out for concentrations of the order of 10 ppm. Several interferences have been evaluated. The spectra of other metal halide complexes will suggest the feasibility of other determinations. (auth)

3364

COLORIMETRIC DETERMINATION OF VANADIUM WITH 8-QUINOLINOL; APPLICATION TO BIOLOGICAL MATERIALS. N. A. Talvitie. Anal. Chem. 25, 604-7(1953) Apr.

During toxicological studies of V, a specific and sensitive method for the determination of this element in biological materials was required. A colorimetric method was developed based on the measurement of the intensity of the magenta-black color of the compound of V and 8-quinolinol in $CHCl_3$ medium. When the color is read photometrically, the method permits the determination of V in the range of 1 to 50 μg with an average error of ±0.32 μg. The method is applicable to studies of the distribution and the rate of excretion of V in experimental animals and is useful in evaluating industrial exposure to V compounds by analysis of urine specimens. (auth)

3365

FLUOROMETRIC DETERMINATION OF ALUMINUM; USE OF 8-QUINOLINOL. Edward Goon, Joseph E. Petley, Warren H. McMullen, and Stephen E. Wiberley. Anal. Chem. 25, 608-10(1953) Apr.

The $CHCl_3$ solution of Al 8-hydroxyquinolate has been successfully used for the colorimetric determination of Al. As the Al complex also fluoresces, this investigation was undertaken to see if the fluorescence was reproducible enough for a quantitative method. A sensitive, quantitative fluorometric method for Al was successfully developed. The fluorescence does not vary critically with time, as is the case with other fluorescent methods for Al, nor with the amount of the reagent used. This method has advantages over a similar colorimetric method in that a smaller aliquot may be used, simplifying the separation procedure, and that in amounts equal to the Al concentration, Fe, Ti, and V do not seriously interfere. (auth)

3366

GRAVIMETRIC METHODS FOR ZINC AND ITS SEPARATION FROM CERTAIN ELEMENTS; USE OF A RADIOISOTOPE IN EVALUATION OF ANALYTICAL PROCEDURES. John E. Vance and Richard E. Borup. Anal. Chem. 25, 610-15(1953) Apr.

The primary objective of this investigation is to evaluate certain gravimetric methods for Zn. The use of Zn-65 allows the determination of the amount escaping precipitation; this information, taken with gravimetric results, indicates whether or not a procedure will remove an element from solution quantitatively and also give a precipitate of the expected composition. A secondary objective is to present quantitative data on the separation of Zn from various elements by the sulfide precipitation. The phosphate procedure can be modified to advantage by the use of a much smaller excess of reagent than previously suggested, adjustment of the pH of the wash liquid, and use of a lower ignition temperature. The precipitation of Zn oxalate is an excellent gravimetric method with ZnO as the weighing form. Either anthranilic acid or 8-quinolinol will remove Zn quantitatively from solution, but empirical factors are needed because the precipitates do not have the predicted compositions. The precipitation of ZnS from a cold sulfate-bisulfate buffer provides a good separation when the ratio of Zn to the foreign ion is at least as low as 1 to 4 Fe, 1 to 2 Ni, 1 to 8 Mn, and 1 to 4 Al. The modified phosphate procedure, the Zn oxalate precipitation, and the sulfide method all will provide average results within 0.1 mg. of the truth as determined both by gravimetric data and by counting unprecipitated Zn-65 in the filtrates. (auth)

3367

DETERMINATION OF ALUMINUM IN ZIRCONIUM; BASED ON SEPARATION BY ION EXCHANGE. Harry Freund and Frend John Miner. Anal. Chem. 25, 564-7(1953) Apr.

No entirely satisfactory method for the determination of small amounts of aluminum in zirconium has been available, owing to the lack of a suitable separation method. This paper describes an ion exchange separation whereby the zirconium in a solution 0.06 M in hydrochloric acid and 0.8 M in hydrofluoric acid is exchanged on a column of Dowex-1, while the aluminum passes through the column. The aluminum may be determined in the eluate by conventional gravimetric or colorimetric procedures. Synthetic samples containing amounts of aluminum varying from 0.001 to 3.8% have been analyzed. As a consequence, a satisfactory method is now available for the separation and determination of small amounts of aluminum in zirconium. (auth)

3368

A RADIOACTIVE TECHNIQUE FOR DETERMINATION OF TANTALUM IN THE FERRONIOBIUMS AND NIOBIUM MINERALS. André Kohn. Compt. rend. 236, 1419-21 (1953) Apr. 8. (In French)

The indicated method permits the determination of Ta without any chemical separation of Ta and Nb. It consists in measuring the activity of samples and standards irradiated together in a slow neutron flux. The tests undertaken have permitted the exact determination of the corresponding importance of the diverse causes of error. The content of Ta can be known to less than 5%. (tr-auth)

3369

DETERMINATION OF LITHIUM IN MAGNESIUM ALLOY BY THE FLAME PHOTOMETER. E. E. Strange. Anal. Chem. 25, 650-1(1953) Apr.

A rapid procedure for determining Li by the Beckman flame photometer in which isolation of Li is not necessary is presented. It was observed that minor amounts of K and Na do not significantly influence the accuracy of the Li determination, but high concentrations of Mg and Al have a depressing effect. (J.E.D.)

3370
THE DETERMINATION OF FLUORIDE BY TITRATION WITH CALCIUM CHLORIDE. R. Belcher and S. J. Clark. Anal. Chim. Acta 8, 222-8(1953) Mar. (In English)

A new method for the determination of fluoride ions is described. Precipitation is effected with an excess of standard Ca chloride and, after standing overnight, the unconsumed Ca ions are back-titrated with EDTA using Eriochrome Black T as indicator. Halides, sulfate, phosphate, and arsenate do not interfere under the recommended conditions. The method is applicable over the range 5 to 65 mg of fluoride ion. (auth)

3371
A NOTE ON THE TITRATION OF LEAD CHLOROFLUORIDE PRECIPITATES USING THE VOLHARD METHOD. R. Belcher and P. I. Brewer. Anal. Chim. Acta 8, 235-8(1953) Mar.

Since it has been reported that a fading end-point is obtained when the Volhard method is used for the titration of Pb chlorofluoride precipitates, a wide range of fluoride concentrations has been examined using this method. The effect of adding various reagents to bind the fluoride ion has been examined. Al ions and boric acid have some effect, but that of ferric ions is the most pronounced. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

3372
Atomic Energy Research Establishment, Harwell, Berks (England)

A STUDY OF THE MONOCLINIC TO TETRAGONAL PHASE TRANSFORMATION IN ZIRCONIA. P. Murray and E. B. Allison. Jan. 21, 1953. 35p. (AERE-M/R-1106)

The kinetics of the monoclinic to tetragonal phase transformation in zirconia have been studied using the change in specific gravity as an index of the amount transformed. The isothermal transformation proceeds according to the equation: $dP/dt = K(100-P)^{2.5}/(100)$, where dP/dt = rate of transformation at time t, and P = amount of monoclinic phase transformed at time t. Application of the Arrhenius relation gives a value for the activation energy of 80,600 cal/g mole of tetragonal phase formed. The course of the transformation for constant heating rate conditions has been predicted by integration of the kinetic constants. The transformation also has been studied under constant heating rate conditions by means of differential thermal analysis and also by a dilatometric method. The results from these alternative approaches compare favorably with those predicted from the kinetic work. The reverse change obtained on cooling the tetragonal phase has been followed. This transformation occurs in a much lower temperature range (950 to 850°C) than the forward transformation (1100 to 1190°C). The tetragonal → monoclinic transition is affected to a considerable extent by high-temperature annealing and also by thermal cycling. It is suggested that this effect is connected with the state of order in the tetragonal lattice. (auth)

3373
Ames Lab.

THE STRUCTURE AND RESIDUAL ENTROPY OF ICE. R. E. Rundle, Institute for Atomic Research, Iowa State Coll. and Ames Lab. [Mar. 25, 1953]. 5p. (ISC-328)

Assuming that water dipoles interact to maintain the maximum net dipole along one direction of the hexagonal axis, that the H–O–H angle ≃ 104 ½°, and that one O–H bond lies along an O–O ligand, one obtains a disordered polar structure with space group C_{6V}^4–C6mc. This structure gives exactly the number of configurations needed to explain the residual entropy and the neutron diffraction data. (J.S.R.)

3374
NEUTRON DIFFRACTION DETERMINATION OF THE CRYSTAL STRUCTURE OF AMMONIUM BROMIDE IN FOUR PHASES. Henri A. Levy and S. W. Peterson. J. Am. Chem. Soc. 75, 1536-42(1953) Apr. 5.

The crystal structures of ND_4Br in four phases have been studied by neutron diffraction. Low-temperature cubic ND_4Br contains ordered, parallel ammonium ions. In tetragonal ND_4Br, adjacent strings of ammonium ions are anti-parallel, and bromide ions are displaced toward a square array of near H atoms. Room-temperature ND_4Br contains ammonium ions at random in two orientations. High-temperature cubic ND_4Br appears to contain ammonium ions in which one, two, or three H atoms make minimal approaches to bromide neighbors; further specification cannot be given from present data. In all structures there appears to be a significant attraction between D and Br. Information about thermal motions in the crystal is derived, including evidence for rotatory oscillation of the ammonium ions. The length of the N–D link is 1.03 ± 0.02 Å (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

3375
MICROWAVE SPECTRUM AND STRUCTURE OF SiD_3Cl. Børge Bak, Jørgen Bruhn, and John Rastrup-Andersen. J. Chem. Phys. 21, 753-4(1953) Apr.

Observed microwave absorption frequencies of the various isotopic silyl chloride molecules and calculated molecular parameters are reported. (G.Y.)

3376
EXCHANGE REACTIONS OF METHANE AND MONODEUTEROMETHANE WITH ATOMIC DEUTERIUM. D. W. Coillet and G. M. Harris. J. Am. Chem. Soc. 75, 1486-7 (1953) Mar. 20.

The distribution of product deuteromethanes from the D + CH_4 and D + CH_3D reactions was determined by mass spectrometry. Reaction mechanisms and possible isotope effects are discussed. (G.Y.)

3377
KINETICS OF TWO EXCHANGE REACTIONS INVOLVING DIBORANE. P. Calvin Maybury and W. S. Koski. J. Chem. Phys. 21, 742-7(1953) Apr.

The kinetics of the exchange between D and diborane were studied over the temperature range 25 to 75°C, and it was found that the reaction was ½-order with respect to diborane and zero-order with respect to D at high pressures. At low pressures the zero-order dependence of the D changed to first-order. The activation energy at the zero-order reaction was 20.4 ± 2 kcal/mole. A mechanism is proposed in which the borine radical reacts with D on the wall and is followed by a rate determining bimolecular collision between the partially deuterated borine radical and a diborane molecule. The closely related exchange reaction between normal and completely deuterated diborane was also investigated. The total order of this reaction was ½, and it had an activation energy of 21.8 ± 3 kcal/mole. A mechanism is proposed which involves the collision between a borine radical and a diborane molecule as the rate-determining step. (auth)

3378
MICROWAVE SPECTRUM AND STRUCTURE OF SiD_3F. Børge Bak, Jørgen Bruhn, and John Rastrup-Andersen. J. Chem. Phys. 21, 752-3(1953) Apr.

Deuterated silyl fluoride (SiD_3F) was prepared by the action of SbF_3 on SiD_3Cl, and the microwave absorption frequencies of the three isotopic (Si) species were measured. Calculated structural parameters are given. (G.Y.)

FLUORINE AND FLUORINE COMPOUNDS

3379

Cryogenic Lab., Ohio State Univ.

THE DENSITY AND SURFACE TENSION OF LIQUID FLUORINE BETWEEN 66° AND 80° K. David White, Jih-Heng Hu, and H. L. Johnston. Feb. 1, 1953. 19p. (NP-4369; Technical Report 19; TR-283-19)

The density of liquid F between 66.03 and 77.22°K is a linear function of temperature, given by the relationship $d = 1.5127 + 0.00635 (T_B - T)$, where d is the density in g/cm^3 at temperature T, and T_B is 85.02°K, the normal boiling point of F. The uncertainty in the density is estimated at ±0.1%. The results on the surface tension, in the temperature region 66.21 to 79.90°K, can be represented by the Macleod equation $\gamma^{1/4}/(d-d') = C$, where γ is the surface tension in dyne cm^{-1}, d the density of the liquid, d' the the density of the gas, and C, a constant, equal to 1.276 ± 0.002. Estimated experimental uncertainty in the surface tension determinations is ±1%. (auth)

3380

New Hampshire Univ.

[STUDIES OF FLUORIDES]; PROGRESS REPORT. Helmut M. Haendler. Oct. 15, 1952. 39p. (NYO-3162)

Data are presented on the action of F on Cu and some of its compounds. Preliminary results are reported on the action of F on Sn compounds, and the reaction of Ti(IV) fluoride with organic compounds. Preparation and characterization of a new compound, $NH_4ZrF_5 \cdot H_2O$, is reported. Preliminary studies of the thermal decomposition of Zr(IV) fluoride trihydrate are discussed. (For previous report in series see NYO-662.) (C.H.)

3381

COMPLEX FORMATION BETWEEN ALKALI METAL FLUORIDES AND METALS OF THE THIRD GROUP. E. P. Dergunov. Translated by G. A. Young from Doklady Akad. Nauk S.S.S.R. 60, 1185-8(1948). 3p. (AEC-TR-2022)

3382

X-RAY EXAMINATION OF POLYCHLOROTRIFLUOROETHYLENE. H. S. Kaufman. J. Am. Chem. Soc. 75, 1477-8(1953) Mar. 20.

Development of crystallinity in KEL-F polymer at temperatures below the first transition temperature at 211°C has been investigated with Debye-Scherrer diagrams. For a given heat treatment the degree of crystallinity developed varied inversely with molecular weight. Structure of the polymer chain was investigated with fiber diagrams. An equation relating molecular weight of the monomer unit and the density is derived. (G.Y.)

3383

HALOGENATION IN THE LIQUID PHASE BY CHLORINE TRIFLUORIDE. THE REACTION WITH BENZENE DERIVATIVES AND WITH CARBON TETRACHLORIDE. J. F. Ellis and W. K. R. Musgrave. J. Chem. Soc., 1063-7(1953) Apr.

When ClF_3 reacts with substituted benzene and benzene homologs, both substitution and addition of Cl and F occur, substitution predominating as with benzene. In all cases Cl substitution is in excess of F substitution but this excess can not be explained by reaction between ClF_3 fluoride and the solvent (CCl_4) giving the chlorinating agent Cl monofluoride. (auth)

GRAPHITE

3384

Alfred Univ.

GRAPHITIZATION OF CARBON; TECHNICAL PROGRESS REPORT. V. D. Frechette and Yung Tao. Mar. 31, 1953. 7p. (NYO-3761)

Study was continued on the improvement of the structure of graphite blocks with special attention to their density. Alcohol was found to be effective in preventing pressure laminations in the formation of graphite blocks by dry pressing. A procedure is presented which was developed to purify graphites for test. Studies on hot pressing, alignment by surface film, and x ray determination of alignment are also reported. (For preceding quarter see NYO 3759.) (C.H.)

3385

ELECTRICAL CONDUCTIVITY OF SINGLE CRYSTALS OF GRAPHITE. Ajit Kumar Dutta. Phys. Rev. 90, 187-92 (1953) Apr. 15.

The electrical conductivities along the principal directions of graphite crystals have been measured using a large number of well-developed single crystals obtained from Ceylon. The conductivity along a direction perpendicular to the hexagonal axis is about 10^4 times that along the axis. Rectification and other nonlinear effects are totally absent. Thickness plays an important part in the determination of the conductivity normal to the hexagonal axis and attempts have been made to avoid this difficulty. These measurements have been extended to temperatures between 80 and 500°K. The conductivity perpendicular to the hexagonal axis falls roughly exponentially with rising temperature and that along the axis rises similarly with temperature. A magnetic field has been found to cause a decrease in both the conductivities—the effect on the conductivity normal to the hexagonal axis being more pronounced. This decrement falls roughly exponentially with rising temperature and has a tendency to attain a steady value at higher temperatures. (auth)

LABORATORIES AND EQUIPMENT

3386

Argonne National Lab.

SERVOS FOR REMOTE MANIPULATION. R. C. Goertz, J. R. Burnett, and F. Bevilacqua. Mar. 26, 1953. 26p. (ANL-5022)

Basic requirements for general-purpose remotely controlled manipulators and the resulting requirements of servos to be used in them are reviewed. Mechanically connected master-slave manipulators and electronically controlled master-slaves requiring special force-reflecting positional servos to supply the linkage between the master and slave arms are described and diagrammatic drawings are included. Servos are described which may be used to vary the functions of the manipulators and thus increase their usefulness. Photographs and diagrams of the electric circuits are included. Equipment of these robots with TV, hearing, and other controls and devices is suggested. (C.H.)

3387

A MINIATURE HELIUM LIQUEFIER-CRYOSTAT OF CASCADE TYPE. P. F. Chester and G. O. Jones. Proc. Phys. Soc. (London) B66, 296-301(1953) Apr. 1.

A miniature cascade He liquefier-cryostat is described which will cool from room temperature to 4.2°K in half an hour and enables continuous experiments to be carried out at or near this temperature, or at intermediate temperatures, for as long as required. It consumes only liquid O_2 and H_2 from high-pressure cylinders, is extremely economical in its consumption of these materials, and incorporates a number of new features which make its operation almost automatic after the starting-up period. (auth)

MOLECULAR STRUCTURE

3388

FORMULATION OF ISOTOPIC SPLITTING IN TERMS OF THE RECIPROCAL KINETIC ENERGY MATRIX. William J. Taylor. J. Chem. Phys. 21, 763-4(1953) Apr.

Expressions for calculation of isotopic shifts in vibration

frequencies from the normal modes of vibration of the non-isotopic molecule are derived and interpreted. (G.Y.)

RADIATION CHEMISTRY

3389

Chicago Univ.

THE EPITHERMAL REACTIONS OF RECOIL ATOMS (thesis). Frank S. Rowland. Aug. 1952. 77p. (AECU-2514)

The retention of neutron-irradiated n-propyl bromide solutions was measured. The Br^{82}-retention values for dilute solutions of several organic bromides in n-pentane and for Br in n-pentane are tabulated. The retention values for the isotopes Br^{80} and Br^{82} and the F value for the crystalline alkyl bromides at −196°C are shown. The retention and F values for the alkyl bromides irradiated in a glassy state at −196°C are shown, together with similar data for those glasses into which a small amount of Br was homogeneously frozen. Results are also shown for chemical effects following (γ,n) reactions. (L.T.W.)

RADIATION EFFECTS

3390

Laboratories for Research and Development, Franklin Inst.

CHEMICAL SYSTEMS SENSITIVE TO RADIATION: MONTHLY PROGRESS REPORT [FOR] JUNE 14, 1951 TO JULY 31, 1951. James Vollmer. 7p. (ATI-111887; Monthly Progress Report P-2260-1)

3391

Illinois Univ.

STUDIES OF EFFECTS OF HIGH ENERGY RADIATION ON CHEMICAL SYSTEMS; BIMONTHLY PROGRESS REPORT [FOR] JUNE 15, 1951 TO AUGUST 15, 1951. G. L. Clark, J. Fuchs, P. E. Bierstedt, and J. O. Gardner. 7p. (ATI-115189; Bimonthly Progress Report 1)

3392

Polytechnic Inst. of Brooklyn

INSULATION; INTERIM REPORT COVERING THE PERIOD JULY 1, 1951 TO SEPTEMBER 30, 1951. J. Steigman, A. Copperman, A. Bender, J. Goodman, and R. Corth. Oct. 15, 1951. 32p. (NP-4434; Interim Report 1)

The Wheatstone bridge method for measuring high resistances has been subjected to analysis and a number of questions were raised concerning its use. A design for a string electrometer for application in the measurement of high resistances is presented. The literature on the effect of ionizing radiation on polystyrene, the degradation of polystyrene, and styrene monomer-polymer exchange phenomena has been reviewed. A brief review of the literature of the irradiation of organic materials pertinent to the problem of the effect of ionizing radiation on alkyl halides is presented in addition to a brief survey of the general aspects of radiation chemistry. It was found, in developing an analytical method for estimating HCl in n-butyl chloride, that diphenylguanidine was not suitable because of the low solubility of the HCl salt. However, preliminary spectrophotometric data strongly suggest the applicability of butter yellow as the base. (auth)

3393

Columbia Univ.

UTILIZATION OF WASTE FISSION PRODUCTS IN CHEMICAL REACTION. A. Czikk, J. Dempsey, S. Engel, and W. A. Selke. Apr. 1, 1953. 15p. (NYO-3329)

A study was made of the accelerating of chemical reactions in the γ-radiation field from a Co^{60} source. The synthesis of ammonia from its elements, the oxidation of SO_2 with air, and the oxidation of benzene in aqueous solution were studied. The oxidation of SO_2 was carried out with V_2O_5 catalyst in a continuous reactor. Radiation seemed to increase somewhat the rate of reaction with low feed-gas temperatures where the reaction rate is appreciable. (For previous report in series see NYO-3328.) (auth)

3394

Atomic Energy Project, Univ. of Calif., Los Angeles

THE EFFECT OF CERTAIN VITAMINS AND ANTI-OXIDANTS ON THE IRRADIATION-INDUCED AUTOXIDATION OF METHYL LINOLEATE. Barbara Hinderer Polister and James F. Mead. Submitted Apr. 27, 1953. 20p. (UCLA-253)

The effect of certain vitamins and antioxidants on the irradiation-induced autoxidation of methyl linoleate has been determined. The ester was protected by Ionol, d-γ-tocopherol, vitamin A acetate, ascorbic acid, glutathione, cysteine, and calciferol, in the order named, while pyridoxine hydrochloride appeared to enhance the reaction. Vitamin A, ascorbic acid, glutathione, and cysteine were partially destroyed in the course of the reaction, calciferol and pyridoxine were unaffected, and tocopherol and Ionol were not oxidized at concentrations high enough for measurement. Catalase had no effect upon the reaction. (auth)

3395

THE DECOMPOSITION OF NITRATE CRYSTALS BY IONIZING RADIATIONS. Gerhart Hennig, Robert Lees, and Max S. Matheson. J. Chem. Phys. 21, 664-8(1953) Apr.

Na nitrate, K nitrate, and K chlorate have been exposed 2 to 4 weeks in the experimental thimble of the Argonne Heavy Water Pile. After exposure, these salts evolve a gas when dissolved in water or when melted or heated to a crystal transition point. The gas yields are in Na nitrate ~0.3, in K nitrate ~0.8, and in K chlorate 2.0 to 3.0 molecules gas/100 ev. For the nitrates this gas has been shown to be largely O which is trapped during irradiation in the gaseous form in small pockets in the crystal. This conclusion is based on the paramagnetism of the irradiated crystals, on chemical analysis of the evolved gases, and on measurements of the amounts of gas liberated in crushing experiments. When irradiated crystals are heated below the melting point, the gas pockets grow and coalesce, this being accompanied by a decrease in crystal density. In irradiated nitrates, oxygen and nitrite ion are formed in equivalent amounts. Experiments with low-energy x rays indicate that most of the decomposition results from electronic ionization and excitation and not from elastic collision of the bombarding particles. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

3396

THE HIGH FIELD CONDUCTANCE OF LANTHNUM FERRICYANIDE AT 25°. Daniel Berg and Andrew Patterson, Jr. J. Am. Chem. Soc. 75, 1484-6(1953) Mar. 20.

Measurements of the high-field conductance of 10^{-4}M aqueous solutions of $La[Fe(CN)_6]$ are reported. The resulting data are compared with the theory of 3-3 valence type electrolytes. (G.Y.)

SEPARATION PROCEDURES

3397

Argonne National Lab.

INTERRELATIONSHIP OF HOLDUP AND THE APPROACH TO STEADY STATE IN BATCHWISE COUNTERCURRENT LIQUID-LIQUID EXTRACTION. Donald F. Peppard and Marvila A. Peppard. Mar. 1953. 29p. (AECU-2510; UAC-737)

An expression is derived for the determination of the number of cycles required for a given approach to steady-state operation of a countercurrent liquid-liquid extraction process. Expressions are derived by means of which the approach to steady-state operation may be calculated rapidly but approximately. (J.S.R.)

3398
THE SEPARATION OF SUGAR PHOSPHATES BY ION EXCHANGE WITH THE USE OF THE BORATE COMPLEX. Joseph X. Khym and Waldo E. Cohn. J. Am. Chem. Soc. 75, 1153-6(1953) Mar. 5.

Borate complexing is used to effect separations of the commonly encountered monophosphorylated sugars by anion exchange in an alkaline chloride system. Phosphoglyceric acid, fructose diphosphate, and the adenosine polyphosphates are separated from the sugar monophosphates and from each other by simple pH and ionic strength adjustment. Using a sequence of eluting solutions of varying borate concentration, chloride concentration, and pH, each member of both groups of substances can be isolated from all of the others in a single continuous process. (auth)

3399
PAPER CHROMATOGRAPHY OF RADIOACTIVE SUBSTANCES. I. M. Hais. Cesk. Farm. 1, 681-704(1952). (In Czech)

A review. 245 references. (G.Y.)

SORPTION PHENOMENA

3400
National Research Council of Canada
SORPTION AND STRUCTURE OF ACTIVE CARBONS. 6. STRUCTURAL TYPES OF ACTIVE CARBONS. M. M. Dubinin and E. D. Zavarina. Translated by Esther Rabkin from Zhur. Fiz. Khim. 23, 1129-40(1949). 33p. (AEC-TR-564; TT-209)

The adsorption isotherms were investigated for benzene vapor for charcoals with varying activations. It was shown that the structure of activated charcoals may be described by the equation of the characteristic curve of the potential theory of adsorption. A detailed analysis of the characteristic curves established the presence of two limiting structural types of activated charcoals—activated charcoals with sinterings not exceeding 50% and charcoals with sinterings exceeding 75 to 80%. The equations of the characteristic curve and of the adsorption isotherm for each structural type was analyzed. In the activated charcoals with sintering of 50 to 75% both types of structure are present. (J.S.R.)

SPECTROSCOPY

3401
Spectroscopy Lab., Ill. Inst. of Tech.
SUBSTITUTED METHANES. 16. VIBRATIONAL SPECTRA, POTENTIAL CONSTANTS, AND CALCULATED THERMODYNAMIC PROPERTIES OF DIBROMODIFLUOROMETHANE; TECHNICAL REPORT ON MOLECULAR SPECTROSCOPY, MOLECULAR STRUCTURE AND THERMODYNAMICS [FOR] SEPTEMBER 15, 1951 TO SEPTEMBER 14, 1952. Charlotte E. Decker, Arnold G. Meister, Forrest F. Cleveland, and Richard B. Bernstein. Submitted Apr. 22, 1953. 12p. (NP-4546; Technical Report 12)

Raman displacements, semiquantitative relative intensities, and quantitative depolarization factors of liquid CBr_2F_2, and infrared wave numbers and the percent transmission in the region 450 to 4000 cm^{-1} for gaseous CBr_2F_2 have been obtained. Satisfactory assignments were made for all the observed bands. Using the Wilson FG matrix method, with a potential function containing all possible second-degree terms, reasonable values of the potential constants were calculated. Finally, the heat content, free energy, entropy, and heat capacity for the ideal gaseous state at 1 atm. were calculated for 12 temperatures, from 100 to 1000°K, using a rigid-rotator, harmonic-oscillator approximation. (auth)

SYNTHESES

3402
Lankenau Hospital Research Inst., Philadelphia
NON-ENZYMATIC TRANSAMINATION WITH GLYOXYLIC ACID AND VARIOUS AMINO ACIDS. Henry I. Nakada and Sidney Weinhouse. Lankenau Hospital Research Inst., Philadelphia and Institute for Cancer Research, Philadelphia and Temple Univ. [1953]. 13p. (AECU-2531)

The formation of glycine at room temperature in solutions containing only glyoxylic and glutamic acids is reported. Glycine was identified by paper chromatography. (C.H.)

3403
Harvard Univ.
THE SYNTHESIS OF ZIRCONIUM, THORIUM AND URANIUM SILICATES; TECHNICAL REPORT FOR JULY 1, 1952 TO MARCH 31, 1953. Clifford Frondel and Richard L. Collette. Mar. 30, 1953. 29p. (RME-3048)

Experimentation described on the ternary system $ZrSiO_4$-$ThSiO_4$-$USiO_4$ has for an immediate objective the synthesis and determination of the properties of the end members. Melt and bomb furnaces have been constructed, hydrothermal bombs designed, constructed, and tested, and designs of temperature regulators for the specific problem tested. The end members, $ZrSiO_4$ and $ThSiO_4$, have been synthesized. The present objectives are synthesis of the latter member, coarse crystalline growth of the other two, the synthesis and x-ray identification of intermediate compounds in the bulk state. A proposed program for the continuation of this work is given in the Appendix. (auth)

3404
Radiation Lab., Univ. of Calif., Berkeley
PREPARATION OF DL-VALINE-4,4'-C^{14}_2, DL-NORVALINE-3-C^{14}, DL-LEUCINE-3-C^{14}, DL-NORLEUCINE-3-C^{14}. R. Ostwald. Mar. 27, 1953. 15p. (UCRL-2154)

DL-valine-4,4'-C^{14}_2, DL-norvaline-3-C^{14}, DL-leucine-3-C^{14}, and DL-norleucine-3-C^{14} have been prepared with high specific activity. The appearance of lower molecular weight amino acids and other by-products was observed in the course of these preparations. Some possibilities as to their origins and identities are discussed. (auth)

3405
THE CHEMISTRY OF THE PERFLUORO ACIDS AND THEIR DERIVATIVES. V. PERFLUOROPROPIONIC ACID. Donald R. Husted and Arthur H. Ahlbrecht. J. Am. Chem. Soc. 75, 1605-8(1953) Apr. 5.

A number of derivatives of perfluoropropionic acid have been prepared and their properties determined. Data are reported for the first time on the anhydride, acid chloride, methyl, ethyl, and isopropyl esters, dihydro amine and dihydro alcohol. Many compounds containing the perfluoroethyl group, C_2F_5-, differ sharply in chemical or physical properties from the adjoining compound containing one CF_2 group more, or one CF_2 group less. (auth)

3406
THE INTRODUCTION OF ISOTOPIC HYDROGEN INTO PURINE RING SYSTEMS BY CATALYTIC EXCHANGE. Maxwell Leigh Eidinoff and Joseph E. Knoll. J. Am. Chem. Soc. 75, 1992-3(1953) Apr. 20.

T or D can be introduced by isotopic exchange in the presence of reduced Pt catalyst into atomic positions in adenine and guanine that do not exchange isotopic H under the usual conditions of aqueous acid or alkali. The catalytic exchange procedure described makes it possible to prepare labeled products of T or D content equal in order of magnitude to that of the aqueous medium used. The catalytic procedure will probably be useful for introducing isotopic H into other compounds having purine ring structures. (J.E.D.)

TRANSURANIC ELEMENTS AND COMPOUNDS

3407

NEW NEPTUNIUM COMPOUNDS. Irving Sheft and Sherman Fried. J. Am. Chem. Soc. 75, 1236-7(1953) Mar. 5. (cf. NSA 4-135)

The preparation and identification of several new compounds of Np are reported, including NpC_2, $NpSi_2$, NpN, and Np_3P_4. In each case the identity of the compound was established from an analysis of the x-ray-diffraction pattern by Prof. W. H. Zachariasen of the Physics Department of the University of Chicago. (auth)

URANIUM AND URANIUM COMPOUNDS

3408

ON THE CERIUM-URANIUM BLUE AND MIXED-CRYSTALS IN THE SYSTEM CeO_2-UO_2-U_3O_8. Walter Rüdorff and Gerhard Valet. Z. anorg. u. allgem. Chem. 271, 257-72 (1953) Mar. (In German) (cf. NSA 6-2062)

Starting from the coprecipitation of Ce(IV) and U(IV) hydrated oxides, CeO_2-$UO_{2.0}$ mixed crystals with the fluorite lattice have been prepared. The crystals are all colored blue. The lattice constants of the mixed crystals follow the Vegard relation. A special case of a mixed crystal with 67 mole % CeO_2 (corresponding to the composition of Ce-U blue) within the mixed-crystal series was not detected. No complete oxidation of the UO_2 to $UO_{2.67}$ could be obtained by ignition of the CeO_2-$UO_{2.0}$ in oxygen. With the support of the fluorite lattice, CeO_2-UO_x mixed crystals are built in which x can be between 2.3 and 2.6. Their lattice constants are smaller than the ones in the corresponding CeO_2-$UO_{2.0}$ mixed crystals. Under special conditions the CeO_2-$UO_{2.67}$ mixed crystals with a fluorite lattice can be formed. The fluorite phase in the system CeO_2-$UO_{2.67}$ extends from 100 to 55 mole % CeO_2. For the saturated mixed crystal with the approximate composition $(Ce_{0.65}\ U_{0.45})O_{2.3}$, a = 5.410 kX. From the density of the CeO_2-$UO_{2.67}$ mixed crystal it is found that the O exists in gaps of the fluorite lattice. With decreasing Ce/U ratio, substitution follows in addition to infiltration. Conductivity measurements in the ThO_2-$UO_{2.0}$ and CeO_2-$UO_{2.0}$ systems have been performed. The specific conductivity of $UO_{2.0}$ ($\sigma = 4 \times 10^{-4}$ mho/cm) is lowered by building mixed crystals with ThO_2. For a mixed crystal with 19 mole % ThO_2 it is found that $\sigma = 3.3 \times 10^{-6}$ mho/cm. For a mixed crystal with CeO_2 about 35 mole % the conductivity rises until $\sigma = 5 \times 10^{-3}$ mho/cm. For higher CeO_2 content σ again decreases but even with 80 mole % CeO_2 the value of $\sigma \cong 3 \times 10^{-5}$ mho/cm. (tr-auth)

3409

ON CERIUM-URANIUM BLUE. G. Brauer and R. Tiessler. Z. anorg. u allgem. Chem. 271, 273-80(1953) Mar. (In German)

From the group of compounds that have been investigated by Hofmann and Höschele and labeled as cerium-uranium blue compounds, a hydrated precipitate of the aqueous solution was investigated under varying conditions by means of chemical and x-ray-diffraction analysis. The results obtained and a test of the resultant colored compound leads to the conclusion that there is found in the material itself not a chemical individual of constant composition, but, with respect to the abundance ratio of U:Ce, a phase of great homogeneity and, with regard to the water content, a hydrated oxide. (tr-auth)

WASTE DISPOSAL

3410

Vitro Corp. of America

SURVEY ON WASTE DISPOSAL: DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT [FOR] JANUARY 1, 1953–FEBRUARY 28, 1953: JOB 24A. Mar. 18, 1953. 10p. (KLX-1386)

Results of a questionnaire survey on radioactive laboratory waste disposal problems are summarized. No technical data are included. (For previous report in series see KLX-1383.) (C.H.)

3411

Vitro Corp. of America

DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT (24-A4); PROJECT SUMMARY [FOR] SEPTEMBER 1, 1950–APRIL 30, 1953, JOB 24-A. May 1, 1953. 48p. (KLX-1389)

Operating instructions and performance data are presented for a laboratory-scale unit using ion-exchange materials to adsorb isotopes and thereby concentrate waste solutions containing radioisotopes to facilitate waste disposal. (For previous report in series see KLX-1386.) (C.H.)

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

3412

Tennessee Univ.

EFFECT OF WETTING ON HEAT TRANSFER CHARACTERISTICS OF LIQUID METALS (thesis). W. K. Stromquist. Mar. 1953. 182p. (ORO-93)

The effect of wetting on heat-transfer characteristics of liquid metals has been investigated by the use of additive wetting agents in Hg to permit direct comparison of wetting and non-wetting heat-transfer data in the same apparatus. The heat transfer system was of the single-tube type, directly heated by electric current in the tube wall. Low-carbon steel tubes of $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{3}{4}$-in. diameter were used as test sections, and pure Hg and 0.02% Na amalgams were used for tests under non-wetting and wetting conditions, respectively. An extensive series of tests was conducted over a range of Prandtl modulus from 0.017 to 0.022, a range of Peclet modulus from 88 to 19,400, and a range of Reynolds modulus from 5150 to 900,000. Results indicate that there is no steady inherent property of a non-wetted liquid-metal system that causes low heat transfer coefficients as compared with a wetted system, and that the erratic heat transfer data sometimes observed in non-wetted systems are due to random local detachment of the liquid from the tube wall. Similar erratic behavior may occur in wetted systems with rough walls. The detachment, with its corresponding erratic heat-transfer behavior, can be prevented by maintenance of sufficient pressure within the fluid, or more generally, by maintenance of a sufficiently high value of the Euler modulus (ratio of static head to velocity head). (auth)

3413

Radiation Lab., Univ. of Calif., Berkeley

EFFECT OF FLUID PROPERTIES ON MASS TRANSFER IN THE GAS PHASE (thesis). Edward J. Lynch. Jan. 1953. 114p. (UCRL-2057)

To determine the effect of fluid properties on the rate of mass transfer in the gas phase, water was vaporized into air, He, and Freon-12. Data were obtained from a series of wet- and dry-bulb experiments on these systems. It is concluded that the mass-transfer coefficient varies with the Schmidt number to the $-\frac{1}{2}$ power for flow perpendicular to single cylinders. In the major phase of the investigation, data were obtained for water vaporization in countercurrent flow in a 1-ft-diam. column packed with 1-in. C Raschig rings. When the data for the 3 gases were compared at a constant value of the gas Reynolds number and constant liquid rate, it was found that the height of a transfer unit

was proportional to the 0.9 power of the Schmidt number. When compared at a constant value of the inertia group, ρu_m^1, and constant liquid rate, the height of a transfer unit was found to be proportional to the 0.47 power of the Schmidt number. With the supporting evidence of the psychrometric study, it is concluded that the inertia group is a more satisfactory correlating modulus than the Reynolds number for mass-transfer rates in packed towers. The dependence of the height of a transfer unit on the liquid rate cannot be expressed as a simple function, but it may be approximated as being proportional to the liquid rate to the $-\frac{1}{3}$ power. (auth)

3414

ON UNSTEADY FLOW OF COMPRESSIBLE VISCOUS FLUIDS. G. Ludford, H. Polachek, and R. J. Seeger. J. Applied Phys. 24, 490-5(1953) Apr.

In order to solve the nonlinear equations of fluid dynamics, classical hydrodynamics introduced the concept of perfect incompressible fluids, viz., the perfect inviscid fluid and the perfect viscous fluid. The practical importance of considering compressibility has resulted in two new approaches from two distinct points of view. In one case, compressibility is included in the discussion of a perfect inviscid fluid. As is well known, however, compressibile effects include shock-wave phenomena, which are regarded in this instance as mathematical discontinuities. The goal then is to study the basic equations, allowing discontinuous solutions. The other approach retains the viscous terms together with the compressible ones. It is based upon the possibility of small coefficients producing large changes in the behavior of the solutions. This paper is written from this point of view. The consequent mathematical difficulties of solving the equations are avoided by the use of a particle model of the continuum. The resulting equations are put into finite difference form for solution on a digital calculator. (auth)

3415

D'ALEMBERT'S PARADOX AND THE MOMENT FORMULA IN THREE-DIMENSIONAL SUBSONIC FLOW. G. S. S. Ludford. Rev. fac. sci. univ. Istanbul 18, 1-13(1953) Jan. (In English)

The disturbed motion produced by the introduction of a body into a uniform stream of perfect inviscid compressible fluid is investigated under the assumptions that the resulting flow is irrotational and devoid of discontinuities extending to infinity. The form of the expansion of the potential function at large distances is shown to be similar to that for the incompressible case. Knowing this result it is possible to calculate the first few terms of the expansion, and hence to show that the force on the body is zero (d'Alembert's paradox) and that the moment is perpendicular to the undisturbed stream. (auth)

3416

EXTENSION OF HEISENBERG'S MODEL OF TURBULENCE TO CRITICAL REYNOLDS NUMBERS. Eugene N. Parker. Phys. Rev. 90, 221-3(1953) Apr. 15.

By considering a few extra physical complications introduced by the presence of boundaries, small velocities, etc., it is possible to extend Heisenberg's methods to the calculation of critical Reynolds numbers. Calculations are carried out for Couette, plane Poiseuille, and Blasius flow. The results are found to be within ~20% of the observed values. (auth)

3417

TEMPERATURE GRADIENTS IN TURBULENT GAS STREAMS; MEASUREMENT OF TEMPERATURE, ENERGY, AND PRESSURE GRADIENTS. W. G. Schlinger, N. T. Hsu, S. D. Cavers, and B. H. Sage. Ind. Eng. Chem. 45, 864-70 (1953) Apr.

Apparatus for measurement of temperature, thermal flux, and shear in turbulent flow is described, and data obtained for a uniform, steady stream of air are presented. (G.Y.)

MATERIALS TESTING

3418

Research Foundation, Ohio State Univ.

INVESTIGATION OF MECHANICAL PROPERTIES AND PHYSICAL METALLURGY OF AIRCRAFT ALLOYS AT VERY LOW TEMPERATURES. PART 4. LOW-TEMPERATURE MECHANICAL PROPERTIES INCLUDING FATIGUE OF TITANIUM-BASE ALLOYS RC-130-B AND Ti-150-A. Joseph W. Spretnak and Mars G. Fontana. Nov. 1952. 40p. (AF-TR-5662(pt. 4))

The yield and ultimate strengths of both alloys increase as temperature is lowered. The increase in ultimate strength at –196°C over the room temperature values is 72% in the case of RC-130-B and 61% in the case of Ti-150-A. Elongation and reduction of area of both materials are decreased at low temperatures. Apparently the notched tensile strength passes through a maximum between room temperature and –196°C. Elastic moduli increase as temperature decreases. Both alloys show low values of impact strength at room temperature, considering their tensile strengths, and the absorbed energy in the impact test drops to low values at temperatures below –78°C. Ti-150-A shows a remarkable high room-temperature fatigue strength of 110,000 psi at 10^7 cycles. The fatigue strength at room temperature of RC-130-B is 84,000 psi. RC-130-B is slightly harder than Ti-150-A at all test temperatures. At –253°C the hardness of both materials increases about 106% over the room temperature hardness. The thermal expansion coefficient of RC-130-B is higher than that of Ti-150-A at all temperatures from room temperature down to –196°C. The thermal expansion coefficients of both alloys decrease as temperature is lowered. (auth)

3419

Bell Aircraft Corp.

GENERAL PROGRAM FOR THE EVALUATION OF TITANIUM AND TITANIUM-BASE ALLOYS AT BELL AIRCRAFT CORPORATION. A. Leach. Apr. 3, 1951. 148p. (BLR-51-57)

Significant data currently available on physical and mechanical properties of Ti and commercially-available Ti alloys are summarized. (313 references). (C.H.)

3420

Metals Research Lab., Case Inst. of Tech.

STRAIN AGING AND RHEOTROPIC RECOVERY; AN INVESTIGATION OF THE EFFECTS OF STRESS CONCENTRATION AND TRIAXIALITY ON THE PLASTIC FLOW OF METALS. E. J. Ripling. Feb. 1953. 26p. (NP-4405; Technical Report 25)

The rheotropic recovery produced in a steel heat-treated to a high hardness level is shown to persist through a second tempering (or aging) treatment up to temperatures at least as high as the initial tempering temperature. The rate at which the ductility of rheotropically recovered metal is lost at low aging temperatures and recovered again at higher temperatures, is far in excess of that found in the same metal under conditions in which the recovery is not necessary. (auth)

3421

Metals Research Lab., Case Inst. of Tech.

NOTCH SENSITIVITY OF STEELS; AN INVESTIGATION OF THE EFFECTS OF STRESS CONCENTRATION AND TRIAXIALITY ON THE PLASTIC FLOW OF METALS. E. J. Ripling. Mar. 1953. 25p. (NP-4487; Technical Report 26)

The portion of room-temperature notch brittleness of a high-strength steel which can be attributed to transition temperature behaviors was determined. An extrapolation

of the super-transition temperature branch of the notched tensile ductility vs. testing temperature curve to room temperature indicated that practically all of the embrittlement resulted from a shift in the transition temperature. (auth)

3422

Institute of Engineering Research, Univ. of Calif., Berkeley

CREEP CORRELATIONS OF METALS AT ELEVATED TEMPERATURES: TECHNICAL REPORT. Oleg D. Sherby, Raymond L. Orr, and John E. Dorn. Mar. 1, 1953. 43p. (NP-4502; Technical Report 25)

Creep and tensile data of pure metals above 0.45 of the melting temp. are correlatable by means of the equations $\epsilon = f(te^{-\Delta H/RT}, \sigma)$ for the total creep strain and $\sigma = f(\dot{\epsilon}_s e^{\Delta H/RT})$ for the stress. These parameters were applied successfully to creep and tensile data for Pt, Ni, Cu, Au, Al, Pb, Fe, and Zn as well as to solid-solution alloys. The activation energy for creep, ΔH, was found to be a constant for a given metal; the activation energies obtained were found to be about equal to the activation energies for self-diffusion of the various metals. In addition, for the elements investigated, ΔH was found to be a periodic function of their atomic number. (auth)

3423

Armour Research Foundation

THE EFFECTS OF CARBON, PHOSPHOROUS, AND ALLOY CONTENTS ON THE NOTCHED BAR IMPACT PROPERTIES OF QUENCHED AND TEMPERED STEELS. H. Schwartzbart and J. P. Sheehan. Feb. 24, 1953. 166p. (NP-4529; Report 39)

The V-notch Charpy impact properties of eight alloy grades of quenched and tempered steel have been investigated. Additional data are presented on the effects of C, P, and alloy contents on the impact properties. Three types of brittleness, manifested by high transition temperatures, were observed: (1) "A" brittleness, or 500°F embrittlement, universally exhibited by practically all steels at all C levels and greatest for the highest C level, 0.80% C. (2) "B" brittleness, or the 1200°F reversal, exhibited by the 2300 series and consisting of an elevation in transition temperature for specimens tempered at 1200°F. (3) Temper brittleness, observed principally in the 0.80% C heat of each grade with the exception of the 2300 series. Steels containing Mo exhibit less temper brittleness than those containing no Mo. The transition temperature of a quenched and tempered steel is dependent, among other things, on C content, alloy content, and tempering temperature. Curves are presented relating these variables. P raises the transition temperatures of 4100 and 5100 steels at practically all C levels and hardnesses. The deleterious effect of this element is greater in the 5100 grade, which contains no Mo, than in the 4100 grade, which contains Mo. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

3424

Atomic Energy Research Establishment, Harwell, Berks (England)

A FUNDAMENTAL INVESTIGATION OF SINTERING PHENOMENA. E. B. Allison and P. Murray. Jan. 1953. 42p. (AERE-M/R-1099)

Data on the sintering of fluorides were obtained by a continuous dilatometric method; the effects of initial compacting pressure and particle size distribution of the powder were also investigated. The results are analyzed in relation to two recent theories of sintering based on a plastic flow model. One of these theories (proposed by Shuttleworth and Mackenzie) is also applied to Clark and White's data for the sintering of glass spheres. It is shown that, while the two mathematical relations may be fitted to experimental sintering data, neither mechanism accounts completely for the effect of compacting pressure and particle size distribution. Activation energies for the flow process are derived, the values being 32 to 37 and 74 to 104 kcal/mole for Na and CaF_2, respectively. The Clark-White mechanism is critically reviewed, and it is shown that their empirical term is not related to particle size as they suggested. Alternative explanations regarding the inclusion of the empirical correction term are proposed. It is pointed out that additional evidence is required regarding the way in which flow occurs in an assemblage of spheres before the appropriate mathematical rate equations can be developed. Further indication that a plastic flow mechanism is operative in sintering is obtained by applying Herring's analysis to the sintering data for different size fractions of CaF_2. (auth)

3425

Armour Research Foundation

INVESTIGATION OF REFRACTORIES SUITABLE FOR MELTING TITANIUM AND ITS ALLOYS. L. E. Marchi and W. A. Scholes. June 10, 1951. 19p. (ATI-109383; Report 1)

CORROSION

3426

Armour Research Foundation

STRESS CORROSION IN AIRCRAFT ALLOYS: FINAL REPORT. Joseph B. McAndrew and Howard T. Francis. May 29, 1952. 23p. (NP-4544)

An attempt has been made to verify the existing theory for the stress-corrosion cracking of Al–4% Cu alloy. The approach used has employed a scanning device, called a "corroscope," which permits a two-dimensional picture to be observed on an oscilloscope, in which is shown the potential distribution in the electrolyte immediately adjacent to the corroding metal surface. Since this potential field is directly related to the current lines flowing from point to point on the specimen, the picture allows direct observation of the location of anodic and cathodic regions on the surface. The x and y directions represent distances on the specimen surface, while the z direction (intensity) reflects the presence of anodic or cathodic elements of the corroding system. Experiments with models verify the reasonably good resolving power and sensitivity of the method. Experiments in which the corroscope has been applied to a study of Al–4% Cu have failed to demonstrate that appreciable currents flow between grain-boundary and grain-center zones of the metal. In view of this result, and in consideration of recent publications by others, a modification of the Dix theory is offered as follows: The grain body-grain boundary couple currents are presumed to serve as an "activating" mechanism for the onset of rapid localized attack at the crack site. This rapid corrosion is thought to occur as a result of the loss of film-repairing ability by the grain-boundary material, brought about in turn by the (relatively small) couple currents. Several experiments are outlined which should permit a test of this hypothesis. (auth)

3427

CORROSION RESISTANCE OF TITANIUM, ZIRCONIUM, AND STAINLESS STEEL IN ORGANIC COMPOUNDS. I. R. Lane, Jr., L. G. Golden, and W. L. Acherman. Ind. Eng. Chem. 45, 1067-70(1953) May.

Ti is resistant to attack by all concentrations of air-

aerated formic acid, but is attacked severely by boiling 50% acid. It is only slightly resistant to this solution at 100°C under O-free conditions. This metal exhibits the phenomenon of "borderline passivity" in certain concentrations of N-aerated 25 and 50% formic acid solutions at 60 and 100°C. Corrosion rates for Zr are negligible. The 20-29 Cr-Ni type stainless steel, in contrast to Ti, is more resistant to O-free formic acid solutions than to those which are air-aerated. The three materials show excellent resistance to all concentrations of acetic acid. Stainless steel is appreciably attacked by boiling acetic anhydride and is severely attacked by boiling chloroacetic acid. Both Ti and Zr are completely resistant to the latter. Ti is much more resistant than Zr to the action of boiling dichloroacetic acid. Neither metal is resistant to boiling trichloroacetic acid. Ti, Zr, and stainless steel are fully resistant to all concentrations of air-aerated lactic, tannic, tartaric, and citric acids. Stainless steel shows appreciable corrosion in all concentrations of boiling lactic acid, whereas the other two metals are fully resistant. Corrosion rates for Ti and stainless steel in boiling 50% citric acid are appreciable, while those for Zr are negligible. Ti exhibits poor corrosion resistance to even very dilute solutions of oxalic acid at elevated temperatures. In contrast, Zr corrodes at very low rates. Stainless steel, while not comparable to Zr, is far more corrosion resistant than Ti in these solutions. Ti and Zr give zero or negligible corrosion rates in air-aerated aniline HCl solutions. Stainless steel is unsatisfactory because of a tendency to form deep pits. The three materials are resistant to boiling chlorinated hydrocarbon–water mixtures. With the exception of stainless steel in CCl_4, these materials also have little or no catalytic effect on the decomposition of the hydrocarbon under such conditions. (auth)

3428

EMBRITTLEMENT OF ZIRCONIUM AND TANTALUM IN HYDROCHLORIC ACID. Lex B. Golden, I. Roy Lane, Jr., and Walter L. Acherman. Ind. Eng. Chem. 45, 782-6(1953) Apr.

Corrosion rates for ordinary-purity Zr induction-melted in graphite were determined in various concentrations of nonaerated and static HCl at atmospheric pressure. Embrittlement occurred in one lot of the metal in a 6-day test in concentrated (37%) HCl, but not in a second lot exposed for 30 days. This has been attributed to differences in the purity of the separate lots of metal. Samples of high-purity arc-melted metal were almost completely resistant under these conditions. High-purity Zr induction-melted in graphite was evenly etched but showed no signs of embrittlement. Arc-melted Zr and commercial Ta were almost completely resistant to concentrated HCl under pressure at elevated temperatures, and neither showed signs of embrittlement. A Zr-Nb alloy (induction-melted) exhibited only shallow surface embrittlement in acid at 100°C. Induction-melted Zr and a Zr-Ta alloy (also induction-melted) were severely embrittled at 100°C. Ordinary purity induction-melted Zr was completely embrittled and disintegrated at 60°C. Forty-six of a total of 103 arc-melted binary Zr alloys containing Ta, Mo, Ag, Mn, Al, and Cr were resistant (that is, corrosion rates were less than 4 mils per year) to concentrated HCl at 60°C under pressure. After testing at 100°C, alloys containing Ta, Mo, Mn, and Al, 22 of the 46 alloys tested, still were resistant and showed few or no signs of embrittlement. In general, increasing amounts of the alloying constituent caused a decrease in the corrosion resistance of the alloys. Arc-melted Zr and some Zr alloys may serve as well as Ta in industrial applications requiring resistance to the corrosive action of HCl, provided, of course, that contaminants are absent or additions of certain chemicals such as ferric chloride have not been made. (auth)

GEOLOGY AND MINERALOGY

3429

Lamont Geological Observatory, Columbia Univ.

NATURAL RADIOCARBON 14 MEASUREMENT AND APPLICATIONS; QUARTERLY PROGRESS REPORT 4 AND 5. J. Laurence Kulp. July 15, 1951. 18p. (ATI-117710; Quarterly Progress Report 4 and 5)

Progress is reported in the study of natural C^{14} measurements and applications. Backgrounds as low as 4.5 cpm were obtained. Modifications in the cosmic-ray tubes, anticoincidence circuit, and screen wall counters were made. The ages of a number of geologically important samples including several tree-ring specimens of known age were determined. A system is in operation for the removal of CO_2 from air. A new apparatus and procedure for obtaining deep ocean-water samples and removing C in high yield was designed, constructed, and tested. (auth)

3430

Lamont Geological Observatory, Columbia Univ.

AGE DETERMINATION OF URANIUM MINERALS BY Pb^{210} J. Laurence Kulp, Wallace S. Broecker, and Walter R. Eckelmann. [1953]. 14p. (NYO-6198)

Satisfactory age determination can be made on U minerals if the ratio of Pb^{206} to Pb^{210} is known. The Pb^{210} (RaD) content is determined by α counting the daughter product Po^{210}(RaF). The fraction of the total Pb which is radiogenic 206 is determined with the mass spectrometer. The agreement of Pb^{206}/Pb^{210} ages with Pb^{206}/U^{238} ages suffices to demonstrate the absence of leaching in the late history of the mineral. (auth)

3431

Division of Raw Materials, AEC

EXPLORATION DRILLING TECHNIQUES ON THE COLORADO PLATEAU. John P. Kellogg. Nov. 12, 1952. 22p. (RME-2)

The Colorado Plateau region in eastern Utah, western Colorado, northwestern New Mexico and northeastern Arizona presents a set of conditions that makes exploratory drilling for U ores a specialized operation. Problems relating to geology, topography, climate, and accessibility require unusual adaptations which only methodical trial and error, united with technology, will be able to solve. Much has already been accomplished. Drilling methods have steadily improved, but new problems arise in accordance with new demands, ore grade differentials, the discovery of new ore horizons, and the ever increasing inaccessibility of outlying deposits. It is the purpose of this paper to discuss certain of these problems in relation to present drilling methods, the more important adaptations made in the past, and the foreseeable future needs. (auth)

3432

Pennsylvania State Coll. School of Mineral Industries

AN INVESTIGATION OF THE MINERALOGY OF URANIUM-BEARING DEPOSITS IN THE BOULDER BATHOLITH, MONTANA: PROGRESS REPORT [FOR] PERIOD OCTOBER 1, 1952–DECEMBER 31, 1952. B. H. Bieler and H. D. Wright. 20p. (RME-3033; Progress Report 2)

The main mineralogical problems in a study of northern Boulder Batholith U deposits are outlined, and laboratory investigations summarized. The "siliceous reef" type deposits were selected for the first part of the study because of their better exposure than the "base metal" kind. Detailed laboratory studies to the present have been confined to the W. Wilson deposit, which supplied more than half of the samples obtained. Laboratory investigations of the W. Wilson deposit have been organized under three groups:

vein and ore mineralogy, wall rock mineralogy, and weathering mineralogy (with emphasis on transportation of U by ground water action, and formation of secondary U minerals). Laboratory studies thus far have been devoted mainly to the first two of these groups. Vein minerals of the W. Wilson deposit include chiefly chalcedony of several types, together with small amounts of pyrite, galena, uraninite and sphalerite deposited approximately in that order. Chalcopyrite and covellite are present in trace amounts. "Quartz monzonite" from the only fresh exposure found contains quartz, labradorite, microcline, quartz, biotite, apatite, zircon, and sphene. All chalcedony veins are enveloped by strongly altered wall rock which merges into the weathered rock between veins. Distribution of alteration products in relation to veins provides evidence of hydrothermal alteration. Essential rock minerals altered in the general order: plagioclase and biotite; orthoclase and microcline; quartz. Hydrothermal alteration minerals include microcrystalline quartz, sericite, kaolinite, and montmorillonite in important amounts, and smaller quantities of chlorite and calcite. Halloysite and illite have been tentatively identified. Evidence is presented concerning the distribution of alteration minerals, which has been studied by thin section, x-ray spectrometer, differential thermal, and electron microscope analysis. (auth)

3433

Minnesota Univ.

URANIUM OCCURRENCE IN ASPHALTITES; TECHNICAL REPORT [FOR] JUNE 1, 1952 TO MARCH 31, 1953. Thomas D. O'Brien. Mar. 31, 1953. 9p. (RME-3040)

The purpose of this work is to establish the form in which U occurs in asphaltite and then determine its relation to the organic (hydrocarbons) constituents. Extractions with organic solvents yielded negligible amounts of U. Basic solutions were most effective. A 10% sodium carbonate solution at reflux temperatures for 3 days extracted over 20% of the contained U. Evidently this U is present as an organo-uranium compound because upon acidification a yellow solid, containing C, H, N, O, and U is obtained. Solution of simple U compounds, or of the oxides by carbonate complexing, do not yield precipitates upon acidification. Distilled water sulfate, but no U. Repeated extractions of the same sample with fresh portions of distilled water show a decrease in pH from 6.5 to 4 indicating a relatively high acid content. Heating of the ore in an inert atmosphere yields a yellow sublimate at 250 to 300°C. This sublimate seems to be the same organo-uranium compound as obtained in the sodium carbonate extraction. Chemical analysis and the infrared spectrum give insufficient data to establish its identity. (auth)

3434

Division of Raw Materials, AEC

ANNUAL REPORT FOR JULY 1, 1952 TO MARCH 31, 1953. John W. Gruner, Lynn Gardiner, and Deane K. Smith, Jr. Issued Apr. 1, 1953. 58p. (RME-3044)

In Part I the results of field work are discussed as far as conclusions have been reached with regard to certain features. For example, the Flop-Over at Temple Mountain is discussed in some detail. Part II contains an account of U-bearing carbonaceous materials which fall into four categories as far as we know now. Part III deals with the syntheses of U-minerals: (1) carnotite, tyuyamunite, and rauvite in the presence of one of the reagents in solid form at room temperature and 100°C; (2) becquerelite from uranyl sulfate and $Ca(HCO_3)_2$ solutions; (3) uranopilite from uranyl hydroxide and uranyl sulfate or H_2SO_4; (4) johannite from uranyl and copper sulfates; and (5) schoepite from uranyl nitrate in the presence of copper nitrate. In Part IV the subject of color changes from red to gray in shales and silts associated with U deposits is discussed. There are only two explanations: the change is caused by reduction of hematite, or the very small amounts of hematite which cause the red color enter the hydromicas with the result that the shales become gray. Part V is a discussion, hypothetical by its very nature, of how much uranium is in sedimentary rocks of the Plateau and how much of it could have been available for making the deposits. The balance is in favor of syngenetic contributions of uranium to the deposits. (auth)

3435

Stanford Univ.

PART 1. STUDIES OF THE MINOR ACCESSORY CONSTITUENTS IN SOME CALIFORNIA BEACH SANDS. PART 2. OPTICAL AND CHEMICAL STUDIES OF MINERALS CONTAINING TANTALUM, NIOBIUM, TITANIUM AND URANIUM AS A PRELIMINARY TO INVESTIGATION OF THE MINERALOGY OF SOME IDAHO PLACER DEPOSITS; ANNUAL TECHNICAL REPORT FOR APRIL 1, 1952 TO MARCH 31, 1953. C. Osborne Hutton. Issued Apr. 1, 1953. 9p. (RME-3045)

A review is presented of methods for concentrating the heavy mineral fraction from the California beach sands. Fifty-one mineral species with specific gravities greater than 2.90 ca were studied and described. Minerals containing Ta, Nb, Ti, and U were accurately identified in order to determine what specific properties might be of value in facilitating correct and rapid identification. This report is a summary of RMO-981. (J.E.D.)

3436

Pennsylvania State Coll.

PETROGRAPHICAL INVESTIGATIONS OF THE SALT WASH SEDIMENTS: PROGRESS REPORT [FOR] DECEMBER 1, 1952 TO MARCH 1, 1953. J. S. Kahn, D. W. Groff, and John C. Griffiths. Issued Mar. 1953. 55p. (RME-3047)

Part I deals with the bulk density measurement on 30 cores from lithological Zone 1 of Well 155C, Bull Canyon. The procedure and experimental design is briefly described and the bulk density measurements are recorded. The variance of bulk density means forms the second basis for determining the number of samples to be used in succeeding analysis. The second part describes the procedures adopted for lithological analysis of cores and details the results of the lithological analysis of cores from Well 155C. The cores from this well are subdivided on the basis of the attribute associations, color, texture and structure into five zones. This zonation is the primary basis for stratified random sampling. Part III refers very briefly to preliminary exploration of some techniques, x-ray, spectrographic, microphotographic and "peels," for analyzing various properties of sediments and particularly for assessing the efficacy of these procedures in the analysis of Salt Wash sediments. X-ray and spectrographic techniques are to be used for detailed estimates of certain aspects of mineral composition (x-ray) and occurrence of ore (spectrograph for V, Ca, etc.). The photomicrographic technique is aimed at analysis of texture, particularly size, shape, orientation, and packing of quartz grains; and for investigating microstructure associated with disturbed bedding—"slumping"—peels of treated rock samples appear to be a suitable approach and are an economical equivalent to thin sections in the case of the finergrained rocks such as mudstones. (auth)

3437

Amherst Coll.

EXPERIMENTAL SIMULATION OF PLATEAU TYPE URANIUM DEPOSITS. George W. Bain. Issued Jan. 1953. 210p. (RMO-44)

Experimental simulation of Colorado Plateau type U deposits is divided into seven parts. The first three summarize the essential features of geological occurrence for the ores. The last four parts outline the results of experimental investigation arranged according to each geological group of features influencing mode of occurrence. Both field distribution and laboratory approaches to the problem suggest that the origin for the U and for the V are disconnected problems. The plateau ores occur in or adjacent to fluviatile sediments and generally avoid flood plain and aeolian accumulations. For this reason, a large part of the rocks of the plateau section are not potential host to economic deposits. The principal deposits occur well down towards the bottom of synclines and are there distributed frequently along a near-contour line; this ore axis may transgress several strata although it stays usually on contour in a stratum. Of the several explanations suggested, only the one attributing the ore to slight redistribution by artesian groundwater fails to leave anomalous situations. The structural and physiographic history of the region indicates earliest age for artesian circulation as late Cretaceous and the youngest age as the Canyon Cutting cycle of the late Pliocene. The ores came into their present site during this time interval. The red jasperoid pebbles of the Shinarump conglomerate carry a small amount of the primeval uranium of the Plateau deposits. The direction to the source for these pebbles was indicated by field studies. The modification of detritus during transportation was investigated experimentally to estimate how far they had come. Rate of change in size of grain and sphericity of grain was measured under controlled conditions and a source estimated to be along the westward extension of the Uncompahgre axis almost 30 miles northwest from the Dirty Devil claims on the San Rafael Swell. Other source regions are believed to have supplied the primeval uranium as heavy detrital minerals and as uraninite occluded in the jasperoid pebbles. The deposition of heavy minerals in intermittent streams was investigated experimentally and the sites determined. Principal deposition occurred in-channel just below scour pools on meanders. Heavy mineral deposition occurred during flood stage and the accumulation was covered by various deposits of the ebb stage. The patterns of the deposits indicated a groundwater flow parallel to structural axes at far below the watertable level in existence when the ores were formed. A simulated aquifer showed that this happens and that the principal groundwater discharge occurs along paths parallel to structures at far below the watertable and near the structural axis of synclines. The effect of rate of recharge and plunge of the structural axis was investigated and the results are presented. Factors influencing precipitation of uranium from uranyl solutions were investigated and it was found that the principal cause for precipitation was reduction in availability of the "vehicle" anion for the uranyl cation. Uranyl sulphate was the principal solution studied. Calcite and V_2O_5 abstracted SO_4 ion and caused precipitation of uranium. Precipitation in the case of calcite was proportional to the original uranyl ion concentration and to the thickness of calcite penetrated. Vanadium was very effective in removing SO_4 ion and caused precipitation of uranium up to exhaustion of the V_2O_5. Many materials, hitherto considered important precipitants, were found to have only minor influence unless accompanied by an SO_4 ion "abstractor." (auth)

3438

Division of Raw Materials, AEC

BIBLIOGRAPHY AND INDEX OF PUBLISHED LITERATURE ON URANIUM AND THORIUM OCCURRENCES IN THE UNITED STATES. PART 2. CALIFORNIA, IDAHO, MONTANA, OREGON, WASHINGTON, AND WYOMING. Margaret Cooper. Issued Dec. 1952. 156p. (RMO-1036)

This bibliography consists of references to published literature, press releases, speeches, and both open-file and other unclassified reports dealing with U, Th, and radioactive occurrences in California, Idaho, Montana, Oregon, Washington, and Wyoming. It represents the second section of a comprehensive bibliography planned to cover references to all similar deposits throughout the world. While the object has been to make the present bibliography as all-inclusive as possible, from the point of view of including all the major papers and at least one reference to each known radioactive occurrence in these States, only references for which the original text was readily available for examination and checking have been cited at this time. The remaining old and new references will be added to this basic list when the section is ready for inclusion in the comprehensive volumes, planned for future publication as a complete bibliography of the entire United States and world. (auth)

3439

Geological Survey

AN AIR CONCENTRATOR FOR VERY LOW GRADE COLORADO PLATEAU URANIUM ORES. L. R. Stieff and E. S. Erickson, Jr. Jan. 1953. 13p. (TEI-307)

An air concentrator, for use on sandstones containing from 0.005 to 0.1% U, consists of an air-scrubbing unit, an air-elutriating column, and a Cottrell precipitator. The concentrates obtained contain more than 10 times as much U per unit weight as the original sandstone. Several modifications are suggested to improve materially the performance of the concentrator. The application of air-concentration methods in the beneficiation of very low-grade U-bearing sandstones from the Colorado Plateau is suggested. (auth)

3440

Geological Survey

RADIOACTIVITY INVESTIGATIONS IN THE SERPENTINE-KOUGAROK AREA, SEWARD PENINSULA, ALASKA, 1946. Robert M. Moxham and Walter S. West. 1953. 11p. (GS-C-265)

Radioactive minerals in small quantities were found in the bedrock and alluvium within the outcrop area of granite at the head of Serpentine River. Tests of radioactivity at outcrops of the granite indicate that small amounts of radioactive material is disseminated throughout the mass. Four variants of the normal granite have been recognized: early and late differentiates, and pegmatitic and fine-grained facies. All variants except the early differentiates show radioactivity in excess of the normal granite. The average equivalent U content of 29 samples of the granitic variants is 0.008%. The heavy-mineral portions of these samples average 0.034% equivalent U. The radioactivity of the placer material and bedrock is attributable to zircon, sphene, allanite, hydrogoethite, and two unidentified secondary minerals. Neither the bedrock nor placer deposits contain sufficient radioactive materials to be of present commercial interest. (auth)

3441

Geological Survey

DISTRIBUTION OF URANIUM IN RICH PHOSPHATE BEDS OF THE PHOSPHORIA FORMATION. M. E. Thompson. 1953. 24p. (GS-B-988-D)

Five sets of "close" samples were analyzed radiometrically for U, and chemically for P_2O_5, CaO, organic matter, and loss on ignition. A Rosiwal analysis was made of thin sections of one set of samples. The results of the analyses have been plotted on graphs and on scatter diagrams, and coefficients of correlation are given for U with CaO, P_2O_5, organic matter, and loss on ignition. Preliminary studies

indicate that the concentration of U in these samples of phosphate rock is not due wholly to phosphate content, but may depend in part on organic matter or on other components. The correlations of U with P_2O_5 are poor in the groups of samples with smaller amounts of U but are good in the groups of samples containing more U. (auth)

3442

THORIUM AND ITS SOURCES IN THE WESTERN HEMISPHERE. A. J. Strod. Am. Ceram. Soc. Bull. 32, 122-3 (1953) April.

Raw material resources of Th and the technology of extraction of thoria from complex and rare earth minerals are discussed. The location of principal monazite deposits in this country and South America is discussed and the history of the development of monazite mining briefly outlined. Reference is made to the sizable deposits of rare earth minerals recently discovered in San Bernardino County, California, and their probable effect on the domestic rare-earth industry. (auth)

3443

THE HAFNIUM TO ZIRCONIUM ABUNDANCE RATIO AND SPECIFIC RADIOACTIVITY OF SOME ORES. R. A. Cooley, A. V. Martin, C. Feldman, and J. Gillespie. Geochim. et Cosmochim. Acta 3, 30-3(1953). (In English)

The Hf-to-Zr abundance ratio and the specific radioactivity of some ores from different continents were measured spectroscopically and by Geiger counter, respectively. Hevesy's postulation of a relation between the radioactivity and Hf content of zircons and the possibility of the abundance ratio serving as a geological indicator are discussed. (auth)

3444

AGE DETERMINATIONS ACCORDING TO THE POTASSIUM-ARGON METHOD WITH CONSIDERATION OF THE DIFFUSION OF ARGON. W. Gentner, R. Präg, and F. Smits. Z. Naturforsch. a8, 216-17(1953) Mar. (In German)

The fluctuation of the ratio of radiogenic A^{40} to K^{40} in the K minerals of the Oligocene strata of the upper Rhine was shown by mass spectrometer measurement to be dependent on the size of the KCl crystals. By assuming the physical conditions in the various strata to be equal and by assuming the A to diffuse outward only, it was possible to calculate the diffusion constant with respect to time. Therefore, both the diffusion constant and the absolute age can be calculated in KCl crystals. The age of the Oligocene was estimated to be 21 ± 3 million years. (J.S.R.)

3445

THE GEOLOGIC CHARACTER OF TYPICAL PITCHBLENDE VEINS. Donald L. Everhart and Robert J. Wright. Econ. Geol. 48, 77-96(1953) Apr.

METALS AND METALLURGY

3446

Battelle Memorial Inst.

INTRODUCTORY PLATING STUDIES ON PROTECTING MOLYBDENUM FROM HIGH-TEMPERATURE OXIDATION. L. E. Vaaler, C. A. Snavely, and C. L. Faust. Apr. 1, 1953. 20p. (BMI-813)

Electrodeposited Ni protected Mo from air oxidation for 100 hr at 1800°F. The best samples lost only 0.1 to 0.2% of the original sample weight (about 3 g). Ni was deposited on Mo after various pretreatments: (1) a-c electrolysis in hydrofluoric acid; (2) a dip in alkaline ferricyanide solution; or (3) a combination of anodic cleaning in alkali, a dip in nitric acid, and a dip in alkaline ferricyanide. In most cases, a thin layer of Cr or Fe was deposited prior to Ni deposition. All deposits blistered when heated to 800°F in a vacuum (100 μ) except when Fe was deposited prior to the Ni. Ni, one mil thick, deposited directly on Mo or over a Cr plate, protected Mo for 100 hr at 1800°F, but Ni over Fe on Mo was not so effective. Attempts were unsuccessful to deposit Cu which would not blister on Mo when heated. (auth)

3447

Battelle Memorial Inst.

THE WELDING OF BETA-STABILIZED TITANIUM ALLOYS; PROGRESS REPORT [FOR MARCH 18, 1952 TO OCTOBER 1, 1952]. G. E. Faulkner, G. B. Grable, and C. B. Voldrich. Oct. 1, 1952. 44p. (NP-4370; WAL-401/97-15)

Four series of binary Ti alloys containing Fe, Mn, Cr, and Mo were arc-cast and fabricated into plate for welding tests. Welds were made in ⅛- and ¼-in.-thick specimens from these alloys and tested to determine bend ductility in the as-welded and heat-treated conditions. Welding tests showed the low alloys to be ductile as welded, the intermediate and high alloys, with the exception of the 15% Cr alloy which had very good ductility, to be brittle as welded. Heat treatment improved the ductilities of some of the welds in the low and intermediate alloys. (J.S.R.)

3448

Utah Univ.

AN ABSTRACT COMPILATION OF THE LITERATURE ON HIGH TEMPERATURE OXIDATION OF METALS. W. Martin Fassell, Jr., Martha S. Chamberlain, and Robert C. Peterson. [nd] 330p. (NP-4492; Technical Report 3, (pt. 2))

3449

Battelle Memorial Inst.

PRODUCTION OF SOUND DUCTILE JOINTS IN MOLYBDENUM; QUARTERLY PROGRESS REPORT [FOR OCTOBER 21, 1952 TO JANUARY 20, 1953]. M. L. Jacobson, D. C. Martin, and C. B. Voldrich. Jan. 30, 1953. 29p. (NP-4532)

Work on the production of sound and ductile welded and brazed joints in Mo indicates that the bend tests made on ⅛- and 1/16-in. power-metallurgy and arc-cast molybdenum sheet showed that all 1/16-in. sheet had good room-temperature ductility parallel to the direction of rolling, but relatively low ductility transverse to the direction of rolling. In tests of ⅛-in. sheet, it was found that Fansteel as-received power-metallurgy sheet had good room-temperature ductility. Westinghouse and Climax ⅛-in. thick sheet had little or no ductility, presumably because they were supplied in the recrystallized condition. (J.E.D.)

3450

Massachusetts Inst. of Tech.

THE GRINDING OF TITANIUM ALLOYS. C. T. Yang and M. C. Shaw. Apr. 1953. 77p. (NP-4552)

This report considers the grinding characteristics of four representative Ti alloys. The rate of wheel wear, surface finish, energy consumed, and metallurgical damage were investigated under a wide range of variables. These variables include: operating variables (wheel speed, transverse and longitudinal feed, depth of cut, and dressing technique), wheel variables (grain type, grain size, wheel hardness, and bond type) and grinding fluids. While most of the experiments were made on the surface-grinding operation the general observations for this type of grinding were also checked for the cylindrical, centerless, and cutoff operations. A resumé of grinding theory is presented and applied to generalize the specific results reported. Wherever possible an attempt has been made to qualitatively explain the experimental observations. Recommendations for the grinding of Ti alloys are presented at the end of the report together with some observations concerning safe practice in Ti grinding. (auth)

3451

Howard Univ.

THE ELECTRODEPOSITION OF BISMUTH; A TECHNICAL REPORT. Kelso B. Morris. Apr. 11, 1953. 12p. (NP-4553)

The conditions for obtaining Bi metal by the electrolysis of molten mixtures of Bi_2O_3 (10% and 25%) and the NaCl-$CaCl_2$ eutectic mixture, are not critical when high cathode-current densities are employed. Bi metal of high purity is obtained easily and with high current efficiencies. Studies, now in progress, involve use of considerably lower cell voltages and lower cathode-current densities. It is believed that, under such conditions, definite relations among the following variables will be found: cathode-current density, cathode-current efficiency, purity of deposit, recoverable metal deposited in unit time, and energy efficiency. (auth)

3452

Naval Research Lab.

THE SOLUBILITY OF IRON IN SODIUM METAL, SODIUM-SODIUM OXIDE, AND SODIUM-SODIUM OXIDE-SODIUM HYDROXIDE. Andrew D. Bogard. Mar. 9, 1953. 10p. (NRL-4131)

The solubility of Fe in Na metal has been determined across the temperature range 236°–540°C in a static system using 46.3-day Fe^{59} as a tracer. The solubility of Fe in Na metal follows the expression: wt.% Fe = $2.88 \times 10^{-7} - 1.63 \times 10^{-9} T + 5.63 \times 10^{-12} T^2$, where T is the temperature in degrees-centigrade. Sodium monoxide, across a similar temperature range increases the solubility of Fe in Na metal by a factor of approximately 10. The solubility at any temperature between 200 and 560°C may be calculated from: wt.% Fe = $3.17 \times 10^{-6} - 1.71 \times 10^{-8} T + 3.51 \times 10^{-11} T^2$. The combined effect of Na monoxide and Na hydroxide increases the solubility by another factor of approximately 10 across the temperature range 250–560°C. The curve follows the expression: wt.% Fe = $8.23 \times 10^{-8} T - 1.30 \times 10^{-5}$. It was found that impurities in the Fe undetectable by chemical or spectroscopic methods appeared in the sodium metal. A stainless-steel and Ni apparatus was used, in which a sample of Na was distilled onto the radioactive Fe, and the sample was removed after saturation at a given temperature and stored in a sample receiver until a series of determinations had been completed. The Fe dissolved in the Na was determined radiometrically. (auth)

3453

Massachusetts Inst. of Tech.

THERMODYNAMICS OF METAL SOLUTIONS; TECHNICAL REPORT, SCOPE 1. Michael B. Bever, George Scatchard, and Carl Wagner. Apr. 27, 1953. 36p. (NYO-925)

The variability of the Ag/S ratio in Ag sulfide has been studied with the help of electrochemical measurements. Ag sulfide coexisting with metallic Ag at 200°C contains a Ag excess of 2.0×10^{-3} g-atom Ag/mole Ag_2S, whereas Ag sulfide coexisting with liquid S has very nearly ideal stoichiometric composition. The variability of the Ag/S ratio in β Ag_2S at 160°C is of the order of 3×10^{-5} g-atom Ag/mole Ag_2S. The interdiffusion coefficient of Ag in Ag_2S at 220°C is about 3×10^3 times greater than the self-diffusion coefficient of Ag in Ag_2S. A thermodynamic calculation gives the result that the transformation temperature of Ag_2S coexisting with metallic Ag is about 1.7°C lower than the transformation temperature of Ag_2S coexisting with liquid S in accordance with observations made by Kracek. (auth)

3454

Pennsylvania Univ.

[SUPERCONDUCTIVITY STUDIES.] ANNUAL REPORT. William F. Love, E. Passaglia, T. Croft, and F. Donahoe. Nov. 1952. 67p. (NYO-3013)

Magnetic studies of superconductivity in alloys of Sn-Bi and Sn-Sb are reported. Samples prepared covering the range of compositions at maximum solid solubility were kept at the corresponding temperatures to keep the solute atoms in solution and also to anneal out inhomogeneities in composition. The Sn-Bi alloys were annealed at 135°C and the Sn-Sb alloys at 225°C. The corresponding limits of solid solubility at these temperatures were determined as 12 and 10 at.%, respectively. The samples were quenched from the elevated temperatures in a low temperature bath and measurements were carried out immediately after the quench. Data on the atomic composition of the samples are presented in tabular form. Typical magnetization curves for the different alloys, data on the effect of annealing on the magnetization curve, critical field data, temperature transition curves, and data on at.% solute for these alloys are presented graphically. An unsuccessful search for superconductivity in a number of sulfides, selenides, and tellurides of various metals is reported. Design is reported of an apparatus for automatically measuring and recording resistance in superconducting metals and alloys. Preliminary results are presented of an investigation of the de Haas-van Alpen effect, and data for Sn and for Zn-Al alloys are presented graphically. (C.H.)

3455

Royal Aircraft Establishment, Farnborough, Hants (England)

THE YOUNG'S MODULUS, POISSON'S RATIO AND RIGIDITY MODULUS OF SOME ALUMINIUM ALLOYS: PART 2. N. Dudzinski. Nov. 1952. 30p. (RAE-MET-69)

Various binary and ternary chill-cast or sintered aluminium alloys were prepared and their elastic properties investigated. It was found that the nitrides of Al, Cr, Mg, Fe, V, Ti and Zr caused an appreciable increase in Young's modulus. Ternary intermetallic compounds showed a similar effect. The specific Young's modulus value was improved by the additions of Cr or Mn. The rigidity modulus value in torsion was similar to that calculated from E and Poisson's ratio. The effect of composition and the heat of formation of various intermetallic compounds is discussed. (auth)

3456

General Electric Research Lab.

FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; SEVENTEENTH QUARTERLY REPORT. J. H. Hollomon and D. Turnbull. Apr. 5, 1953. 14p. (SO-2027; Progress Report 34; RL-867)

Preliminary results on the self-diffusion of Pb in Ag and additional data on grain-boundary self-diffusion in Ag are reported. A portion of the Cu-Au phase diagram is constructed from emf measurements on a high-temperature galvanic cell, and the existence of a two-phase region between ordered and disordered Cu-Au is supported. The low-temperature specific heats of Se, Te, Sb, and other anisotropic solids have been more completely analyzed in terms of the lattice anisotropy. (For preceding period see SO-2026.) (auth)

3457

General Electric Research Lab.

DEVELOPMENT OF ZIRCONIUM BASE ALLOYS; FOURTEENTH QUARTERLY REPORT. J. H. Keeler. Apr. 5, 1953. 9p. (SO-2509; Progress Report 15; RL-868)

Additional tensile tests of Zr-Al-Zr-Mo, Zr-Ta, and Zr-Nb binary alloys were carried out at temperatures up to 300°C. A modified end-quench apparatus has been constructed to further investigate the influences of thermal treatments on the properties of Zr alloys. The tensile properties of unalloyed Zr were determined at −195°C, and the melting temperature of crystal-bar Zr was determined as 1868 ± 10°C. (auth)

3458

Armour Research Foundation

RESEARCH AND DEVELOPMENT TOWARD IMPROVING TITANIUM-ALUMINUM BINARY ALLOYS BY THE ADDITION OF A THIRD COMPONENT: SUMMARY REPORT. H. D. Kessler. [1953]. 103p. (WAL-401/103-18)

Ti-Al-Cr and Ti-Al-Mo alloys were studied in detail as

examples of two types of ternary alloys based on the Ti-Al system which would be expected to respond to widely differing heat treating procedures. The theoretical considerations leading to the selection of the ternary systems investigated are discussed in the first portion of the report. The alloys investigated contained up to 6% Al and up to 6% Cr or 10% Mo, depending on the alloy system. The $\beta/\alpha + \beta$ transformation temperatures, end quench hardenability curves, time-temperature-transformation diagrams, and age-hardening relations were determined for these alloys prior to detailed tensile and impact test studies. A brief investigation was made of the tensile and impact properties of Ti-Ta and Ti-Al-Ta alloys containing up to 6% Al and 5% Ta. (auth)

3459

Armour Research Foundation

RESEARCH AND DEVELOPMENT TOWARD IMPROVING TITANIUM-ALUMINUM BINARY ALLOYS BY THE ADDITION OF A THIRD COMPONENT: INTERIM TECHNICAL REPORT FOR SEPTEMBER 1, 1952–DECEMBER 31, 1952. 24p. (WAL-401/103-22; Interim Technical Report 4)

The work was directed to the addition of other elements to binary Ti-Al alloys to produce alloys superior to those now available, both in strength and toughness. Six Ti-Al-Fe and six Ti-Al-V alloys were prepared by the two-step arc-melting method. Tensile studies were performed on these alloys in several conditions of heat treatment. Various cooling rates from the beta solution treating temperature were used; namely, water quench, oil quench, air cool, and furnace cool. The tensile test results are correlated with microstructure and hardness. (auth)

3460

New York Univ.

GRAIN SIZE CONTROL IN TITANIUM AND THE EFFECT THEREON OF VARIOUS ADDITION AGENTS: FINAL REPORT. Y. C. Liu and Harold Margolin. Nov. 14, 1952. 58p. (WAL-401/105-16)

The control of grain size in α-titanium by deformation and annealing was studied. Recrystallization curves for iodide and sponge Ti with different initial structures were determined between 350 and 850°C for reductions of 10 to 60%, as well as for binary alloys of iodide Ti with 0.1 and 0.5% C, 0.1 and 0.5% Ni, 0.1 and 0.5% V, 0.1 and 0.5% Al, and 0.1% N (by weight). Grain sizes were determined for specimens annealed at 750 and 850°C. Activation energies for recrystallization were calculated from hardness data on four Ti-base alloys reduced 60% by cold rolling. (auth)

3461

New York Univ.

TITANIUM-RICH TERNARY PHASE DIAGRAMS OF TITANIUM WITH CHROMIUM AND CARBON, MANGANESE AND CARBON, CHROMIUM AND NITROGEN, MANGANESE AND NITROGEN: FINAL REPORT. E. Ence, W. Kirk, and H. Margolin. Oct. 30, 1952. 58p. (WAL-401/105-17)

Determination of the phase diagrams of the systems Ti-Cr-C, Ti-Mn-C, Ti-Cr-N and Ti-Mn-N in the Ti-rich corner of the diagrams. The ternary systems containing Cr have been investigated in the temperature region 650-1350°C and in the nominal composition range up to 2% C or N and up to 21% Cr. The ternary systems containing Mn have been investigated in the temperature region 535-1350°C and in the nominal composition range up to 2% C or N and up to 24% Mn. (auth)

3462

REFINING OF ALUMINUM. Masao Ishizuka (to the Japanese Government). Japanese Patent 176,576, July 31, 1948. Translated by Toshio Nakai. 4p. (AEC-TR-2025)

Al of high purity can be obtained by the electrolysis of an aqueous $Al(NO_3)_3$ or $Al_2(SO_4)_3$ solution containing either HAc or propionic acid. (J.S.R.)

3463

SOLDERING OF Be, Al, Zr, U, W, AND Al-Li ALLOY. E. Creutz. Rev. Sci. Instr. 24, 330-1(1953) Apr.

A method employing "hot-dipping" techniques is presented for soldering the above metals to Cu or some other metal plate. In general, the metal to be soldered is tinned by dipping through a molten flux into a molten solder of the proper composition, after which standard torch or soldering-iron techniques are used. A list of the flux and solder combinations for the respective metals is given. (L.M.T.)

PHYSICS

3464

Laboratory for Nuclear Science, Mass. Inst. of Tech.

PROGRESS REPORT [FOR THE PERIOD NOVEMBER 30, 1952 TO FEBRUARY 28, 1953]. Feb. 28, 1953. 74p. (AECU-2494; [Progress Report 28])

Separate abstracts have been prepared for four sections of this report. (For preceding report see AECU-2347.) (L.T.W.)

3465

Laboratory for Nuclear Science, Mass. Inst. of Tech.

CHEMISTRY OF THE FISSION ELEMENTS GROUP and COSMIC RAY GROUP and ELEMENTARY PARTICLE SCATTERING GROUP. D. H. Hume, L. B. Rogers, B. Rossi, R. W. Williams, H. S. Bridge, and J. R. Zacharias. p.1-22 of PROGRESS REPORT [FOR THE PERIOD NOVEMBER 30, 1952 TO FEBRUARY 28, 1953]. Feb. 28, 1953. 22p. (AECU-2494(p.1-22))

Progress is briefly reported on the following studies: analytical chemistry of In and Ce, spectrophotometric determination of silica, polarographic and coulometric studies with stationary electrodes, analysis of the system Pb-dithizone, east-west effect of positive and negative mesons near the equator, photomeson production, and angular anisotropies of various fragments from photofission of Th^{232} compared to the anisotropy of Ba^{139}. (L.T.W.)

3466

Laboratory for Nuclear Science, Mass. Inst. of Tech.

ONR GENERATOR GROUP and RADIOACTIVITY AND CYCLOTRON GROUP. W. W. Buechner, R. D. Evans, and M. S. Livingston. p.35-57 of PROGRESS REPORT [FOR THE PERIOD NOVEMBER 30, 1952 TO FEBRUARY 28, 1953]. Feb. 28, 1953. 23p. (AECU-2494(p.35-57))

Progress is briefly reported on the following studies: measurement of energy levels of Li^6, B^{10}, and N^{14} from proton and deuteron scattering, levels in B^{12} from the $B^{11}(d,p)B^{12}$ reaction, energy levels of Ca^{40}, and the spectrum of G-M counter pulses as affected by resolving time and counting rate. (L.T.W.)

3467

Argonne National Lab.

THEORY OF A-C SPACE-CHARGE POLARIZATION EFFECTS IN PHOTOCONDUCTORS, SEMICONDUCTORS, AND ELECTROLYTES. J. Ross Macdonald. Mar. 3, 1953. 54p. (AECU-2511; UAC-733)

A linear theory is developed of the a-c behavior of solid or liquid materials containing charge carriers which can move freely within the material but cannot leave it through the electrodes. The theory applies for any degree of dissociation of neutral centers and recombination of positive and negative charge carriers, but these carriers are

assumed to have been produced by dissociation from only one species of neutral center. The mobile carriers may be electrons, positive holes, positive ions, negative ions, positive ion vacancies, or negative ion vacancies. The general solution for the admittance of the material is obtained for an arbitrary ratio between the mobilities of positive and negative carriers, but, because of the complexity of the result, it is only discussed in detail in the present paper for the following special cases: (a) charge carriers of only one sign mobile, arbitrary recombination time; (b) charge carriers of both signs mobile with the same mobility, arbitrary recombination time; and (c) charge carriers of both signs mobile with unequal mobilities and very short recombination time. In case (a), two dispersion regions may appear, with that at lower frequencies arising from recombination and the other from the finite mobility of the carriers. Both regions follow Debye dispersion curves accurately over a wide frequency range, making it possible to represent the electrical behavior of the material for any recombination time by means of a simple equivalent circuit containing only frequency-independent elements. In cases (b) and (c), only the motional dispersion region appears and it again follows Debye curves. Finally, the results of the present theory are compared with those of other theories of a-c space-charge effects in semiconductors and electrolytes. (auth)

3468

Michigan Univ.

INSTALLATION AND OPERATION OF TEN-KILOCURIE COBALT-60 GAMMA RADIATION SOURCE. John V. Nehemias, L. E. Brownell, W. W. Meinke, and E. W. Coleman. [1952]. 10p. (AECU-2525)

A brief discussion on some of the problems involved in the installation and operation of a 10-kilocurie Co^{60} γ-radiation source is presented. Some of the studies being undertaken on the effects of γ radiation upon biological and chemical systems are discussed. (J.E.D.)

3469

Research Lab. of Electronics, Mass. Inst. of Tech.

ELECTROMAGNETIC WAVE PROPAGATION ON HELICAL CONDUCTORS. Samuel Sensiper. May 16, 1951. 123p. (NP-4466; Technical Report 194)

The results of a theoretical investigation of the properties of the natural waves or "free modes" which propagate along infinite helical conductors are reported. The sheath model which replaces the helix by an anisotropic cylindrical sheet is considered. The higher modes are investigated and it is found that several waves per mode can exist. The significance of these waves in terms of inward and outward traveling waves from a source is shown. The manner in which the characteristics of these waves change as the parameters of the system are altered is discussed. A more physically realistic model of the helix than the sheath model is analyzed. The exact formulation shows the existence of bands where free mode waves are not permitted. The cases of a single-wire helix wound with a very narrow tape and a very wide tape for which reasonably valid approximations can be made are analyzed, and solutions are obtained. The usual low-frequency behavior predicted by the sheath model and the anomalous behavior of the propagation constant in the region where the circumference of the helix is approximately equal to a wavelength result from these solutions. The problem of multiwire helices is considered, and the manner in which the sheath helix model is obtained as the number of wires becomes infinite is shown. The integral formulation of the small-wire helix problem yields results essentially identical to those obtained by means of the methods and approximations indicated above. This formulation allows a solution for the infinite driven helix to be obtained, and although this is not completely evaluated, the free mode portion is extracted. (auth)

3470

Naval Research Lab., Univ. of Wis.

THE QUANTUM MECHANICS OF COLLISIONS BETWEEN DIATOMIC MOLECULES. C. F. Curtiss. Jan. 30, 1953. 23p. (NP-4526)

The quantum mechanics of collisions between diatomic molecules is discussed. Explicit expressions for the angular-transition probabilities are obtained. These expressions are in terms of a set of coefficients which are defined by the asymptotic form of the solutions of a set of coupled differential equations in one variable, the separation of molecules. The coupled differential equations involve integrals of the intermolecular potential function, which may be of any form. A solution of the coupled differential equations by a perturbation method, which is valid in the case of low-energy collisions, in which transitions occur rarely, is discussed. (auth)

3471

DETERMINATION OF THE THERMODYNAMIC ACTIVITY OF CONSTITUENTS OF MOLTEN SYSTEMS FROM THE SOLIDIFICATION DIAGRAMS. M. Maurice Rey. Translated from Compt. rend. 228, 473-5(1949). 2p. (AEC-TR-2024)

3472

HIGH TEMPERATURE HEAT CONTENTS OF HAFNIUM DIOXIDE AND HAFNIUM TETRACHLORIDE. Raymond L. Orr. J. Am. Chem. Soc. 75, 1231-2(1953) Mar. 5.

High-temperature heat contents of HfO_2 and $HfCl_4$ were measured from 298.16°K to 1804 and 486°K, respectively. A table of smooth heat-content and entropy-increment data above 298.16°K was compiled, and heat-content equations representing the data were derived. (auth)

3473

ON THE HYDRODYNAMICS OF NON-VISCOUS FLUIDS AND THE THEORY OF HELIUM II. PART II. A. Thellung. Physica 19, 217-26(1953) Mar. (In English)

The theory developed in a previous publication (see NSA 7-868) which was confined to the irrotational flow of a non-viscous fluid, is extended so as to include vortex motions. With the aid of a transformation due to Clebsch it is possible also in this general case to bring the hydrodynamical equations into a canonical form. The total hamiltonian is then found to consist of three parts of which the first, involving only the "phonon field," was dealt with in the earlier work. The second part contains exclusively the "roton field," while the third part represents an interaction between the two fields. In this way the concepts introduced by Landau in connection with his interpretation of the properties of He II can be given a more secure foundation. Quantization is carried out along the usual lines of field theory. A determination of the eigenvalues of the hamiltonian has not yet been achieved. (auth)

3474

ON THE MOLECULAR THEORY OF LIQUID HELIUM. THE COEFFICIENT OF THERMAL EXPANSION OF LIQUID HELIUM. I. Prigogine and J. Philippot. Physica 19, 227-34(1953) Mar. (In French)

The cell model applied to liquid helium by the authors in their first communication (see NSA 7-849) is slightly extended. The volume per cell and the total number of cells are obtained by the condition of minimum free energy. In this model the number of cells which accomodate two particles is not equal to the number of cells with zero particles. The results obtained in the first paper are not appreciably changed but the present model permits explanation not only of the anomalous specific heat and increase of entropy, but also of the negative thermic dilata-

tion of the liquid He at temperatures below the λ point. (auth)

3475
DIFFUSION OF D_2 FROM D_2O THROUGH STEEL. Francis J. Norton. J. Applied Phys. 24, 499(1953) Apr.

Heavy water, D_2O, and air were introduced into an outer glass vessel at 90°C. The presence of a little liquid D_2O at the bottom insured saturation conditions. This outer vessel surrounded a steel vacuum chamber, which was kept very slightly cooler. Thus, liquid condensation and corrosion occurred on the exterior of this low carbon steel chamber, 200 cm^2 in wall area and 0.16 mm thick. The interior led directly to a mass spectrometer. When the D_2O was introduced on the outside of the steel vacuum chamber, at 90°C, the D_2 peak at mass 4 appeared within three minutes, and a flow of 4×10^{-6} cm^3/min (NTP) was established for D_2 through the steel wall. No D_2O peaks were found, indicating no leak in the steel chamber. When air was removed from the outside, the D_2O being left, the D_2 rate of permeation was greatly reduced, showing that O from the air is involved in the process. (auth)

3476
SOME SCIENTIFIC APPLICATIONS OF HIGH SPEED-ROTATION. P. B. Moon. Brit. J. Appl. Phys. 4, 97-101(1953) Apr.

A general account is given of scientific uses of rotary apparatus, including high-speed shutters for neutrons, Doppler effect measurements with γ rays, and work with molecular beams. Classical applications are briefly mentioned and the principles of rotor design are discussed. (auth)

3477
X-RAY SCATTERING FROM LIQUID HELIUM. J. Reekie, T. S. Hutchison, and C. F. A. Beaumont. Proc. Phys. Soc. (London) A66, 409-10(1953) Apr. 1.

The structure of liquid He has been studied by x-ray scattering at temperatures between 4.2 and 1.36°K. Both He I and He II gave a typical "liquid-ring" diffraction pattern. In addition to the main maximum at an angle of 28.5°, a subsidiary maximum appeared at ~55° at all temperatures. The latter seemed less well-marked in exposures made above the λ point. (G.Y.)

3478
ON THE POLARIZATION OF HIGH ENERGY BREMSSTRAHLUNG. K. Phillips. Phil Mag. (7) 44, 169-72(1953) Feb.

An attempt has been made to determine whether the bremsstrahlung from a 20-Mev betatron is polarized. The experiment consists essentially of measuring the angular distribution, with respect to the plane of emission of the photons, of photoprotons produced in the photodisintegration of the deuteron. The distribution instead of being purely symmetrical, as would be expected for unpolarized bremsstrahlung, indicates some asymmetry. (auth)

3479
CARE OF RADIUM SALTS. S. C. Lind. Nucleonics 11, No. 4, 56, 58(1953) Apr.

Methods of handling Ra salts are reviewed, emphasizing the sealing process that is necessary to prevent the escape of Rn and prevent capsule rupture from internal pressure. The two causes of internal pressure are: (1) the inevitable accumulation of He over a period of time, and (2) pressure resulting when the Ra salt has not been thoroughly dehydrated. The "air lift" method for rapidly removing the Ra capsule, when measurements are being made requiring a very short time, has resulted in three serious accidents in the U. S. in the last two years, and it is suggested that this method be abolished. Since the Ra salts can be easily dehydrated, this cause of internal pressure build-up can be eliminated. The use of a soda-lime glass container inside the usual metal container and frequent inspections for Rn leaks are suggested as remedies to the problem of capsule rupture. (L.M.T.)

COSMIC RADIATION

3480
Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)
CONCORD OF COSMIC RAY COMPONENTS IN THE ATMOSPHERE. P. Budini, Trieste Univ. (Italy) and G. Molière, Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil). Dec. 28, 1952. 24p. (NP-4539; Physics Note 10)

A deductive quantitative mathematical description of the development of cosmic-ray components in the atmosphere is presented. The starting point of the theory is the spectrum of primary cosmic radiation (considered mainly as protons). From this the energy spectrum of the N component in its dependence on the atmospheric depth is first calculated. The resultant nucleonic spectra then serve as a source from which the spectra of the other components (for instance, those which we observe at sea level as "cosmic radiation") are derived. Two simplifying assumptions are used in the method: all angular deviations of the secondary particles from the primary direction are neglected, and the "creation spectra" are homogeneous and depend only on the energies of the created and colliding particles. (L.M.T.)

3481
WORLD-WIDE EFFECTS OF CONTINUOUS EMISSION OF COSMIC RAYS FROM THE SUN. V. Sarabhai and R. P. Kane. Phys. Rev. 90, 204-6(1953) Apr. 15.

The Carnegie Institution barometric pressure-corrected, cosmic-ray, meson-intensity data for solar time daily variation at Huancayo, Cheltenham, and Christchurch have been harmonically analyzed. Time series covering the period 1937 to 1946 have been derived for variations of the amplitude and hour of maximum of the meson diurnal variation. These reveal that the amplitude and hour of maximum undergo large long-term world-wide changes. The time series for mean of the diurnal amplitude observed at the three stations has high positive partial correlations with relative sunspot number and American magnetic character figure. The correlations are higher during years of low sunspot activity. The new evidence confirms earlier experimental findings of the authors indicating that the barometric pressure-corrected, meson-intensity, diurnal variation is caused by an anisotropy of the primary cosmic rays connected with the emission of high-energy charged particles from the sun. In addition, it reveals that the sun is a continuous source of cosmic radiation, the activity of emission varying broadly in step with the solar cycle. (auth)

3482
DIFFUSION OF THE NUCLEONIC COMPONENT IN THE ATMOSPHERE. A. Ueda and H. Hasegawa. Progr. Theoret. Phys. (Japan) 8, 262-3(1952) Aug.

A simple model of the nucleon cascade is presented as an aid in interpreting the diffusion of the nucleonic component in the atmosphere. The fine structure of the diffusion of the nucleonic component, such as the variation of the mean free path with energy and atmospheric depth, is determined. (L.M.T.)

3483
SLOW NEUTRONS IN THE COSMIC RADIATION, I. Yoichi Fujimoto and Taro Tamura. Progr. Theoret. Phys. (Japan) 8, 221-30(1952) Aug.

The diffusion of cosmic-ray neutrons in the atmosphere is calculated by using the recent experimental neutron cross sections for the computation of the age τ. It is found that

the correct boundary condition at the top of the atmosphere is necessary for the analysis of the data at stratosphere. Assuming the neutron sources to be stars, the altitude variation and the absolute density of slow neutrons is obtained and compared with experiments. (auth)

3484
ON THE COSMIC-RAY BURSTS UNDERGROUND; THE INTERACTION OF π-MESON WITH NUCLEON. Syuzo Ogawa. Progr. Theoret. Phys. (Japan) 8, 205-11(1952) Aug.

A high-energy μ meson can produce a π meson by means of its electromagnetic field when it collides with a nucleon. The energy dependence of the cross section for this process is analyzed from the view point of the perturbation method including higher-order corrections, when only the pseudoscalar (direct) coupling of the π meson with the nucleon is assumed. Next, retaining the character of the cross section thus obtained, a phenomenological cross section for this process is assumed and applied to the analysis of cosmic-ray bursts underground. Then it is found that consistency between the theory and the experiment seems unattainable when only direct coupling is taken into account. (auth)

3485
OBSERVATIONS OF EXTENSIVE COSMIC-RAY SHOWERS BELOW GROUND. E. P. George, J. W. MacAnuff, and J. W. Sturgess. Proc. Phys. Soc. (London) A66, 346-56 (1953) Apr. 1.

The decoherence curve of extensive showers has been studied at a depth of 60 m w.e. below ground out to a distance of 320 m. The relative frequencies of coincidences in various combinations of counter sets are found to be consistent with the assumption that the frequency of showers containing N particles is proportional to $N^{-\gamma}$ with $\gamma = 3.2 \pm 0.2$. By comparison with observations at other depths it is concluded that the particles in extensive showers are absorbed less rapidly in the earth than the normal particles of the vertical component. The observed showers can be readily understood in terms of the small fraction of penetrating particles (presumed μ mesons) that is known to exist in extensive showers observed at sea level. At counter separations less than 3 m the observed coincidences are much too frequent to be attributed to extensive showers, indicating a significant contribution from locally produced penetrating particles. The origin of these secondary particles is discussed. (auth)

3486
PRODUCTION OF FAST DEUTERONS IN COSMIC RAYS. A. Alikhanyan and G. Marikyan. Doklady Akad. Nauk S.S.S.R. 87, 191-4(1952) Nov. 11. (In Russian)

Studies of the mass spectrum of cosmic particles at 3200 m elevation by magnetic analysis showed the presence of deuterons with 250 to 450 Mev energy and abundance ~10% of the number of protons. (G.Y.)

3487
A NEUTRAL V-PARTICLE FROM A LOW-ENERGY NUCLEAR INTERACTION. J. P. Astbury, J. S. Buchanan, G. D. James, D. D. Millar, J. A. Newth, D. I. Page, A. B. Sahiar, and A. Rytz. Phil. Mag. (7) 44, 352-5(1953) Mar.

In a recent paper (Astbury, et al. (Phil. Mag. (7) 43, 1283 (1952)) attention was drawn to the fact that charged V particles can be produced in nuclear interactions where the total energy involved is $\sim 5 \times 10^9$ ev. In this letter an event is described which shows that at least one type of neutral V particle can be produced in interactions of similar energy. (cf. Phil. Mag. (7) 44, 242(1953)). (L.M.T.)

3488
DISINTEGRATION OF COSMIC RAY HEAVY NUCLEI. K. Gottstein. Naturwissenchaften 40, 104-5(1953) Feb. (In German)

A systematic study of the energy spectrum of heavy ($Z > 2$) primaries was made with Ilford G5 emulsions exposed at $\lambda = 55°$ at 29 km altitude. Grain and δ-ray densities and angular distribution of collision fragments indicated the following distribution of heavy primaries: $3 \leq Z \leq 5$, 36.5%; $6 \leq Z \leq 9$, 40.5%; $Z > 9$, 23%. These results conflict with those published by other investigators. At least 11% of the particles have energies per nucleon >3 bev, 40% > 1 bev, and 77% > 350 Mev. Thus, 23% have energies below the cut-off energy of the earth's magnetic field. It is concluded that ~20% of all heavy primary fragments observed within the atmosphere are from disintegrated heavy nuclei. (G.Y.)

3489
AUGER SHOWERS AND THE DENSITY OF THE HIGH ATMOSPHERE. Alice Daudin and Jean Daudin. Compt. rend. 236, 1352-4(1953) Mar. 30. (In French)

Measurements of the geometric effect of air density on Auger shower fluctuations have been made with radiosondes at isobaric levels of 700, 500, 300, 200, and 100 millibars. A search was made for a variable that, associated with pressure, would reduce the statistical scattering of daily averages to a minimum. The superiority of the temperature at the 300 mb level over the local temperature as such a variable is noted. (G.Y.)

3490
THE MEAN LIFE OF CHARGED V-PARTICLES. J. P. Astbury, J. S. Buchanan, P. Chippindale, D. D. Millar, J. A. Newth, D. I. Page, A. Rytz, and A. B. Sahiar. Phil. Mag. (7) 44, 242-8(1953) Mar.

Eight hundred tracks of slow particles have been photographed during a cloud chamber experiment on penetrating showers. Measurements of tracks produced by ten heavy, negative, non-decaying particles are presented. The total observed time of flight of these particles is 1.6×10^{-8} sec. After combining this time with the number of slow V particles observed to decay in the cloud chamber, it is concluded that at least one type of heavy meson must have a mean life greater than 4×10^{-9} sec. (auth)

3491
ON THE STATISTICAL ESTIMATION OF MEAN LIFE-TIMES. M. S. Bartlett. Phil. Mag. (7) 44, 249-62(1953) Mar.

Statistical methods of estimation of the mean life times of unstable particles from cloud chamber photographs are discussed (1) for decaying particles only, and (2) when non-decaying particles can be recognized. Some discussion is also given of the effect of momentum errors and of estimation and discrimination problems for mixtures of particles. (auth)

3492
DELAYED DISINTEGRATION OF A HEAVY NUCLEAR FRAGMENT: I. M. Danysz and J. Pniewski. Phil. Mag. (7) 44, 348-50(1953) Mar.

A photomicrograph is presented of two coincident events observed in a G5 emulsion, 600 μ thick, which was exposed to cosmic radiation at 85,000 feet. From the analysis of the black and grey tracks of the first star A, nine α particles, one heavy fragment, and eleven singly charged particles were identified. The center of the second star B (a 4-prong star) coincides with the end of the track of the heavy fragment ejected from A. Star A results from a high-energy interaction, presumably between a singly charged particle of ~30-bev energy and a Ag or Br nucleus. The initial kinetic energy of the heavy fragment from A was estimated as ~60 Mev, its final energy was very small, and its time of flight was $\sim 3 \times 10^{-12}$ sec. The total energy of the emitted particles for the event in star B was found to be ≥120 Mev. The probability of a chance coincidence between the end of the heavy-fragment track and the center of star B was found

to be <1 in 10^7. Alternative interpretations of the event are proposed. (L.M.T.)

3493

DELAYED DISINTEGRATION OF A HEAVY NUCLEAR FRAGMENT: II. D. A. Tidman, G. Davis, A. J. Herz, and R. M. Tennent. Phil. Mag. (7) 44, 350-2(1953) Mar.

An observation very similar to that reported by Danysz and Pniewski (see preceding abstract) is reported. This event occurred in a G5 emulsion, 400 μ thick, exposed in a balloon flight at 96,000 feet and 40°N geomagnetic latitude. The observations are not inconsistent with the view that one of the nucleons of the fragment was a V_1^0 particle as proposed by Danysz and Pniewski. (L.M.T.)

3494

ENERGY SPECTRA OF COSMIC-RAY PHOTONS AND ELECTRONS FROM PLASTIC SCINTILLATION COUNTER MEASUREMENTS. C. N. Chou. Phys. Rev. 90, 473-6 (1953) May 1.

A new method of measuring high-energy photons and electrons is reported. Using an experimental arrangement consisting of G-M counters and scintillation counters with large plastic scintillators, the number-vs.-size distribution of cosmic-ray showers produced by photons and electrons in a Pb block of one-inch thickness was measured. From the results of shower theory the energy spectra of cosmic-ray photons and electrons at Chicago (600 ft above sea level and 51°N geomag. lat) were deduced. The results of the present investigation show that in the energy range of 0.3 to 2.0 bev, the differential energy distributions can be represented by a power law of the form E^{-s}, with $s = 2.71 \pm 0.13$ and 2.81 ± 0.13 for the photon and electron components, respectively. The exponent s decreases considerably at energies below 0.2 bev. An essential part of this investigation is to provide a suitable means of measuring the energies of energetic γ rays or electrons, or the energy distribution of energetic γ rays or electrons. The results show that scintillation-counter arrangements consisting of large plastic scintillators are suitable instruments for these purposes. This method could also be applied to energy measurements of photons and electrons from high-energy accelerators. (auth)

ELECTRICAL DISCHARGE

3495

Radiation Lab., Univ. of Calif., Berkeley

PARTICLE INITIATED HIGH VACUUM SPARKS. Harry G. Heard and Eugene J. Lauer. Mar. 16, 1953. 13p. (UCRL-2051)

Experiments on the initiation of vacuum sparks over a wide range of voltages, gap spacings, and electrode geometries are described. Sparks are initiated by particles which are removed from the vacuum liner by mechanical shock or are generated by a secondary spark gap. (auth)

GASES

3496

Brookhaven National Lab.

THE EFFECT OF ISOTOPIC SUBSTITUTION ON THE ENTROPY, ENTHALPY AND HEAT CAPACITY OF IDEAL GASES. 1. SYSTEMS IN THERMAL EQUILIBRIUM. 2. CHEMICALLY REACTING SYSTEMS. Jacob Bigeleisen. [1952]. 22p. (BNL-1364)

The formulas of Bigeleisen and Mayer for the free-energy difference between isotopic compounds are used to derive formulas for the similar differences in entropy, enthalpy, and heat capacity. Tables of these functions are calculated. The analogous quantities in the "thermodynamics of reaction rates" are discussed. Several useful formulas for the entropy differences of isotopic molecules are derived. (auth)

3497

ERRATUM: CONSTANTS IN THE EQUATION OF STATE OF A GAS. Leo F. Epstein. J. Chem. Phys. 21, 762(1953) Apr.

An error in the paper with the above title (J. Chem. Phys. 20, 1981(1952); NSA 7-612) is corrected. (G.Y.)

INSTRUMENTS

3498

David Sarnoff Research Center

ELECTRONIC DEVICES FOR NUCLEAR PHYSICS; QUARTERLY REPORT [FOR] OCTOBER 1952–JANUARY 1953. G. A. Morton, P. W. Davison, M. W. Green, and M. H. Greenblatt. Apr. 13, 1953. 22p. (AECU-2528; Quarterly Report 10)

The photoelectric response of Li_3Sb for whole light and blue light is reported. The preparation of Li_3Sb photocathodes and additional studies of Cs_3Sb photocathodes are described. Discussions are presented of the experiments which are under way to measure the emission time spread and distribution of secondary electrons. Further observations on the after-pulsing phenomenon in photomultipliers are reported. Some of the information gained from the recent photocathode work was used in constructing H-4646 multipliers and performance data of these tubes are reported. (For preceding period see AECU-2327.) (L.M.T.)

3499

Columbia Radiation Lab., Columbia Univ.

FOURTH QUARTERLY PROGRESS REPORT FOR THE YEAR 1952. Dec. 31, 1952. 39p. (NP-4542; Quarterly Progress Report 4)

Design, and operating characteristics of various types of magnetrons are discussed. The apparatus for determining the space-charge distribution in a static magnetron is described. New designs for a magnetron harmonic tuner and h-f directional couplers are described. Results of the calculation of the resonant frequency of the bunching cavity for a flat electron beam are given. Changes in the microwave equipment which will be used in the hfs studies of the H atom and singly ionized He are reported. A strong microwave absorption spectrum due to the free radical $O^{16}H^1$ was found upon passing a r-f discharge through H_2O vapor. A cryostat which has been designed for magnetic resonance-absorption studies is shown. (For preceding period see NP-4313.) (L.M.T.)

3500

Naval Research Lab.

A THREE-LEVEL CAPILLARY VISCOMETER FOR THE STUDY OF ANOMALOUS FLOW IN SEALED SYSTEMS. John G. Honig and C. R. Singleterry. Apr. 14, 1953. 13p. (NRL-4133)

A three-level viscometer for the study of non-Newtonian flow in sealed systems is described. The instrument is simple in design and operation, and permits repeated and reproducible measurements. The absolute dimension of the instrument may be determined from x-ray photographs and direct measurements. The viscosities of Newtonian oils calculated from the dimensions of the instrument taking account of corrections which have been evaluated, agree with those reported by the National Bureau of Standards for the same oils. The viscometer was designed to permit measurements in a sealed instrument on a system whose viscosity may vary over a hundredfold range. The rheological properties of non-Newtonian systems can usually be characterized by a pair of constants derivable from equations fitting the flow data over the range observed. In general, one constant describes the consistency level of the system under specified conditions of shear, and the other characterizes the deviation of the flow behavior from the Newtonian relation between shearing stress and rate

of shear. Such constants present data for non-Newtonian flow in more compact and comparable form than do the graphs usually employed. The derivation of such constants from the widely applicable Ostwald-deWaele equation is discussed and the constants compared with those derived from some other equations which have been proposed. (auth)

3501
Oak Ridge National Lab.
FILAMENT LIFE EXTENSION IN HIGH-INTENSITY ION SOURCES. O. C. Yonts. Issued Apr. 27, 1953. 10p. (ORNL-1525)

A new mode of operation is presented which results in increased filament life for high-intensity ion sources. (auth)

3502
A MIXER FOR A SYSTEM OF PHOTOMULTIPLIERS. P. Chagnon, L. Zernow, and L. Madansky. Rev. Sci. Instr. 24, 326(1953) Apr.

A circuit is shown with which signals from several photomultipliers can be mixed while maintaining the bandwidth available in commercially available distributed amplifiers. A diagram is shown for a 4-stage mixer with a gain slightly less than unity. Additional stages can be added by constructing identical sections. (L.M.T.)

3503
POSITIVE AND NEGATIVE IONS IN CATHODE-RAY TUBES. C. H. Bachman, G. L. Hall, and P. A. Silberg. J. Applied Phys. 24, 427-33(1953) Apr.

The positive and negative ions accompanying the operation of a cathode-ray tube contribute in a number of ways to tube failure. These ions have been studied in standard sealed-off tubes. The identities of the most persistent ions have been determined and ion currents measured. Some attempts to limit or control the ions at their sources have been made. The greatest offender is H which is present as both negative and positive ions. It is shown that aluminized screens offer little protection to the ion bombarded phosphor. Uncertainity in the literature as to whether negative m/e, 26, is C_2H_2 or CN seems resolved in favor of C_2H_2. (auth)

ISOTOPES

3504
A SEARCH FOR Si^{32} IN NATURAL SILICON. A. Turkevich and Althea Tompkins. Phys. Rev. 90, 247(1953) Apr. 15.

Two samples of quartz that had been exposed to an intense neutron flux have been examined radiochemically for the presence of 25-day P^{33}. Only P^{32}, formed presumably from impurities, has been found. Using the limits of detectability and analysis conditions and assuming 0.05 barn for the neutron capture cross section of Si^{32}, an upper limit of 4×10^{-6}% results for the abundance of Si^{32} in natural silicon. (auth)

MASS SPECTROGRAPHY

3505
MASS SPECTROMETER INVESTIGATION OF THE IONIC EMISSION OF ALUMINUM SILICATES. Jacques Beaussier and Georges Couchet. Compt. rend. 236, 1417-19(1953) Apr. 8. (In French)

Thermal ions emitted from the surfaces of alkaline Al silicates were studied to obtain information on the process of ion emission. The ion emission can be activated or considerably modified by superficial phenomena, as minute surface impurities and residual air pressure. At elevated temperatures very clear traces of corrosion were obtained when the filament broke. Two stages are apparent in the emission of thermal ions: an internal emission similar to the phenomenon of electrolysis and a surface emission responsible for the activation and final formation of the ions. (J.S.R.)

MATHEMATICS

3506
California Univ., Berkeley
DEGENERATE PERTURBATIONS. David C. Kleinecke. Feb. 1953. 18p. (NP-4507; Technical Report 1)

The theory developed is based on and extended from work in a paper by I. M. Lifshitz (J. Exptl. Theoret. Phys. (U.S.S.R.) 17, 1017(1947)). The proofs given here are new, simpler, and more general in application. The perturbation problem considered here concerns itself with the spectral values of the operator A + P, assuming those of A as known, where P is a degenerate operator. The principal novelty of this approach is that no assumptions of smallness are made for P, nor is any form of analyticity used. (auth)

3507
ON THE FORMULATION OF QUANTUM MECHANICS ASSOCIATED WITH CLASSICAL PICTURES. Takehiko Takabayasi. Progr. Theoret. Phys. (Japan) 8, 143-82(1952) Aug.

By re-expressing the generalized Schroedinger equation in its coordinate representation in terms of amplitude and phase of the state vector, a quantum-mechanical change of a system can be made to correspond to an ensemble of classical motions of the system to which is added some internal potential. This ensemble may be taken as statistical. This enables an alternative formulation of quantum mechanics which is associated with that classical picture. Such a formulation leads, however, if developed straightforwardly according to the picture, to a theoretical scheme quite different from that of ordinary quantum mechanics concerning problems other than the equation of motion. Furthermore, this formulation is not applicable to fermions when spin or exclusion principle is taken into account. Bohm's recent renewed form of the statistical interpretation of quantum mechanics referring to this formulation is criticized on several points. On this formulation a singular ensemble can be constructed which is shown to correspond to the transformation kernel of the wave function to an infinitesimally later instant, and thus a connection between this formulation and that of Feynman's is taken out. A hydrodynamical picture formally equivalent to the statistical picture in one-body problems is also considered, and from such analogy certain formal generalization of the Schroedinger equation is suggested. (auth)

3508
THE VIRIAL THEOREM IN FREE ELECTRON AND GENERALIZED THOMAS-FERMI MODELS. N. H. March. Phil. Mag. (7) 44, 346-7(1953) Mar. (cf. NSA 6-6658).

In another paper (Phil. Mag. (7) 43, 1042(1952)) the author discussed the virial theorem in the Thomas-Fermi and Thomas-Fermi-Dirac theories. These models refer to absolute zero and have been generalized to apply when $T \neq 0$. This note briefly records some results arising from an investigation of the form of the virial theorem in these generalized models. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

3509
Chicago Univ.
METHOD FOR THE ROUTINE ABSOLUTE INTENSITY AND ENERGY MEASUREMENTS OF BETA RADIATION; APPLICATION TO NATURALLY RADIOACTIVE POTASSIUM, RUBIDIUM, RHENIUM AND LUTETIUM (thesis). Andrew D. Suttle, Jr. Aug. 1952. 106p. (AECU-2524)

A method is presented for the routine absolute intensity and energy measurements of β radiation where accuracies no greater than 5 or 10% are desired. The method utilizes close cylindrical geometry for a screen-wall counter, which consists essentially of the usual center wire around which

the sample being measured is placed on the inner wall of the cylinder. A screen cathode is placed between the wire and the sample to ensure the smoothness of the electric field near the cathode. Principal use was made of a gas between the sample and the screen cathode as an absorber so that absorption curves of very weak β emitters could be determined. By means of the techniques developed, the half lives and energies of K^{40}, Rb^{87}, Re^{187}, and Lu^{176} were determined. (L.M.T.)

3510

School of Aviation Medicine

EVALUATION OF THE LAND SELF-DEVELOPING FILM BADGE DOSIMETER. John E. Pickering. May 1951. 7p. (ATI-115466)

3511

Brookhaven National Lab.

ON THE SURFACE EFFECT OF SODIUM IODIDE SCINTILLATORS. E. der Mateosian and Luke C. L. Yuan. [1952]. 6p. (BNL-1362)

Experimental results are reported which indicate that the response of a NaI-Tl crystal (chemically cleaned in a conventional process) to a 5-Mev α particle is nonlinear with energy when compared with a γ ray of 661 kev (Cs^{137}). This nonlinearity was not ascribed to a surface effect of the crystal since the nonlinearity was found to exist both for internal and external α sources. Some saturation effect was indicated for the scintillation process. The surface effect of the chemically cleaned NaI crystals was found to be less than 5% of the total energy of α particles of 5 Mev. (C.H.)

3512

Chemical Research Lab., Teddington, Middlesex (England)

THE C^{14} COUNTING EFFICIENCY AND BACKGROUND OF A LIQUID SCINTILLATION COUNTER. B. N. Audric and J. V. P. Long. Mar. 1953. 13p. (CRL/AE-102)

The efficiency of a liquid scintillation counter with a dissolved C^{14} source of known activity has been determined. The residual background after reduction of noise, γ-ray, and cosmic-ray pulses has been examined and the magnitude of the various components estimated. A counting efficiency of approximately 43% is obtained over a volume of 20 ml with a residual background of 30 cpm with the apparatus at room temperature. (auth)

3513

Los Alamos Scientific Lab.

LABORATORY HANDBOOK OF NUCLEAR MICROSCOPY. J. C. Allred and A. H. Armstrong. Feb. 1953. 62p. (LA-1510)

This handbook was originally intended to serve as a guide to the nuclear microscopist and as a reference for the supervisor in the nuclear microscopy laboratory at Los Alamos. A revision is presented here which includes more recent information. The Leitz Ortholux microscope is described and its operation and calibration are discussed. General discussions are presented concerning nuclear emulsion plates, charged particle and neutron detection, and the experimental techniques and analyses of plates. Considerable information such as range-energy relations, n-p scattering cross section per 0.25 Mev, moisture and H content of emulsions as a function of relative humidity, development techniques, etc., is appended. (L.M.T.)

3514

Institute of Industrial Research, Syracuse Univ.

NON-ELECTRONIC DOSE RATE INDICATING SYSTEMS: QUARTERLY PROGRESS REPORT [FOR] SEPTEMBER 15–DECEMBER 15, 1952. Myron G. Berry and Henry Linschitz. 132p. (NP-4400; Quarterly Progress Report 2)

References are reviewed in a descriptive manner presenting a fairly complete survey of the literature from 1895 to 1952 on reversible effects of radiation. The attempt was to indicate the main qualitative discoveries and to tell where quantitative data can be located. Articles on effects of β and γ radiations, as well as x radiation, were included. Some articles on effects of α particles are included where they also apply to effects of other types of energetic radiation. (891 references). (C.H.)

3515

Polaroid Corp.

DEVELOPMENT OF PHOTODOSIMETERS OF THE "DRY DEVELOPMENT" TYPE: FINAL REPORT [FOR] APRIL 1, 1951 TO DECEMBER 1, 1952. Dwight P. Merrill. [nd] 87p. (NP-4401)

The self-developing film badge or radiac detecting element, developed in the preceding contract was readily adapted to manufacture by mass production machinery. A variety of negatives and processing solutions was tested. Those selected provided ranges of 0.5 to 50 r and 20 to 600 r. These ranges were found to be reproducible within a given lot of components. Difficulty occurred, however, in maintaining the required range from lot to lot of the components. The variability of the negative between lots was particularly troublesome. Reliability of the γ-ray calibration was thoroughly tested at high and low ambient temperatures and humidities. In comparison with material processed by conventional (wet process) means, the "dry development" type radiac detectors displayed no anomalies. Heat exposure alone, giving an apparent dose without γ-ray exposure, was used to determine the most advantageous relative humidity for assembly of the detectors. Excessive dryness destroyed the desired uniformity of the image by producing negative wrinkle and curl. Heat together with γ-ray dosage was found to increase the apparent sensitivity of the detector except near the F and L steps of the reference gray scales. Accuracy was found to suffer if more than 24 hr elapsed between irradiation and processing of the radiac detectors. The processing of the detector in the film holder was found to be critical to alignment of the spreading surfaces, force between these, and to the manner of attachment of the spreader spring. (auth)

3516

De Paul Univ.

SCINTILLATION TECHNIQUES APPLIED TO ELECTRON ENERGY STUDIES: QUARTERLY PROGRESS REPORT [FOR] OCTOBER 1, 1952 TO DECEMBER 31, 1952. Edwin J. Schillinger, Jr. 18p. (NP-4488; Quarterly Progress Report 3)

The present status of the project may be summarized as follows: (1) The scintillation counter has been constructed and tested; (2) the design of the electron accelerating unit is complete and assembly is essentially finished; and (3) all electronic circuits to be employed in taking data have been tested and are accurate to ~2%. (For preceding period see NP-4206.) (L.M.T.)

3517

Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro (Brazil)

NOTE ON THE DIFFUSION OF RADIOELEMENTS IN NUCLEAR EMULSION. Elisa Frota-Pessôa. Dec. 30, 1952. 8p. (NP-4540; Physics Note 11)

In previous experiments the author observed that the number of 4-branch stars in nuclear emulsions formed by the α particles emitted by the elements Ra^{226}, Rn^{222}, Po^{218}, and Po^{214}, successively, was <1% of the number of Ra^{226} atoms which disintegrated during the exposure. This result, which was in contradiction to R. Flament's provision of 20%, assuming no diffusion of radioelements (Bull. centre de phys. nucléaire univ. libre Bruxelles No. 3, (1948)), was justified by the diffusion of Rn^{222} in the nuclear emulsion in

analogy with the known diffusion of Rn^{220}. This suggested two other experiments in which the diffusion of the Rn^{222} was further confirmed. It is also shown that the descendants of the radon, Pb^{214} and Bi^{217}, suffer diffusion in the nuclear emulsion. The existence of diffusion in the family of U^{235} is also indicated. A method of determining the Ra content of a mineral, even when it contains Th, by the observation of Rn stars in nuclear emulsions is proposed. (L.M.T.)

3518
Lamont Geological Observatory [Columbia Univ.]
A LOW LEVEL RADON COUNTING SYSTEM. G. L. Bate, H. L. Volchok, and J. L. Kulp. [nd] 20p. (NYO-6202)

A stable, convenient system for low-level counting of Rn is described. The system permits a precision of ±1% with an efficiency of about 80%. The lower limit of measurement is the amount of Rn in equilibrium with about 10^{-14} g of Ra. A vibrating-reed electrometer is used to amplify slow pulses obtained from an ionization chamber operated at 300 v. The cumulative pulse count is recorded by a mechanical register following amplification of the output of the electrometer. Special care in construction and selection of the ion-chamber materials permits an α background as low as 15 cph for a 4-liter volume. Chemical pretreatment of the gases is unnecessary for most samples. (auth)

3519
Oak Ridge National Lab.
A NEUTRON TIME-OF-FLIGHT SPECTROMETER (thesis). Gerard S. Pawlicki. Issued Apr. 24, 1953. 52p. (ORNL-1526)

A complete description is given of a mechanical-shutter neutron time-of-flight spectrometer which has been installed at Oak Ridge National Lab., including the theoretical design criteria associated with the construction and operation of the instrument. Initial testing operations are reported, the most serious difficulty being the excessively high background due primarily to unmoderated fission neutrons. To relieve the situation temporarily, a 6-in. Al filter was placed in the beam, resulting in a 25% decrease in counting rate and a fourfold decrease in background; the permanent solution was accomplished by placing more moderator near the reactor. After absolute calibration of the apparatus, transmission studies were made with Ag, Cu, and In samples. (L.M.T.)

3520
THE USE OF STRIPPED EMULSIONS FOR RECORDING THE TRACKS OF CHARGED PARTICLES. C. F. Powell. Phil. Mag. (7) 44, 219-22(1953) Feb.

Although the need for thick emulsions in cosmic-ray and other high-energy particle observations is well known, the inherent distortion and microscopic-examination problems connected with their use have limited their applications. A detailed description of the alternative method, the use of stripped emulsions, is presented here. A stack of 50 stripped emulsions, 6 × 4 in., 600 μ thick with thin tissue paper separating them were exposed to cosmic radiation at ~40,000 ft. Each of the individual emulsions was then made to adhere to a specially treated glass plate, by dipping it in 1% glycerine and, after drying, processed in the usual way. The most serious problem in securing plates free from distortion is to avoid the formation of blisters in the gelatine during fixation, and ways of preventing this are described. The technique of following particle tracks through the emulsions is also discussed. (L.M.T.)

3521
BETA SPECTROGRAPH WITH PRISM AND DOUBLE FOCUSING OBTAINED BY MEANS OF AIR-CORE COILS. A. Moussa. Physica 18, 1120-3(1952) Dec. (In French)

Design and focusing properties are described briefly. (G.Y.)

3522
VALIDITY LIMITS OF CALCULATION BY SUCCESSIVE APPROXIMATIONS OF THE AXIAL AND RADIAL FOCUSING IN PRISM β SPECTROGRAPHS. J. Lafoucrière. Physica 18, 1124-8(1952) Dec. (In French)

3523
ANNULAR CORRECTION OF A MAGNETIC LENS. P. Hubert, P. Grivet, and J. Seiden. Physica 18, 1136-8(1952) Dec. (In French)

The correcting element is placed on the counter-source axis within the main coil. The correction realized is discussed briefly. (G.Y.)

3524
DOUBLE BETA COINCIDENCE SPECTROMETER. C. A. Mallmann. Physica 18, 1139-41(1952) Dec. (In English)

A β spectrometer previously developed (NSA 4-3776) has been adapted as a double coincidence spectrometer; design and properties are discussed. (G.Y.)

3525
THE EFFICIENCY OF THE ANTHRACENE SCINTILLATION COUNTER FOR LOW ENERGY ELECTRONS. D. K. Butt. Physica 18, 1142-6(1952) Dec. (In English)

The counting efficiency of the anthracene scintillation counter for low-energy electrons has been redetermined with improved light-gathering power between the crystal and photocathode. Integral pulse-amplitude curves taken for electron energies of 8 and 4 kev are interpreted. (G.Y.)

3526
UTILIZATION OF THE PROPERTIES OF THE CAUSTIC IN MAGNETIC LENS SPECTROMETERS. P. Hubert. Physica 18, 1129-35(1952) Dec. (In French)

3527
HIGH RESOLUTION AND HIGH PRECISION BETA-SPECTROMETRY. R. E. Siday. Physica 18, 1063-5(1952) Dec. (In English)

In the spectrometry of any physical quantity, the design of apparatus to give the highest resolution may be quite different from that designed to give great precision in an absolute determination. In applying this idea to β spectroscopy, it seems that both can be achieved separately by very simple, although entirely different, types of apparatus. The advantages of several such single-purpose instruments recently constructed are discussed. (G.Y.)

3528
A SIMPLE CONTINUOUS CLOUD CHAMBER. W. Riezler and R. Werz. Naturwissenschaften 40, 138-9(1953) Feb. (In German)

A small (23-cm diameter), glass-walled, dry-ice-cooled continuous cloud chamber is illustrated. Relative values of various gaseous fillers and other properties are discussed, and some samples of particle tracks observed with the instrument are shown. (G.Y.)

3529
MEASUREMENT OF BETA PARTICLES OF LOW ENERGY AND ALLIED PHENOMENA. S. C. Curran. Physica 18, 1161-70(1952) Dec. (In English)

Advantages and difficulties in the use of proportional tubes as β-ray spectrometers are discussed, and various applications to the measurement of low-energy β spectra, low-intensity and highly-forbidden β transitions, low-energy positron emitters, and K capture are reviewed briefly. (G.Y.)

3530
SOME NOTES ON COLLIMATED COMPTON SPECTRA. D. G. E. Martin and G. Parry. Physica 18, 1157-60(1952) Dec. (In English)

The arrangement of a 180° β spectrometer to give a low background for the study of Compton electrons ejected from a target by a collimated beam of γ rays is discussed. The effects of scattering at those sections of spectrometer walls

that do not lie within the shadows cast by defining slits have been investigated. The importance of scattering of electrons at these walls is shown. An arrangement giving a low background counting rate which varies only slowly with energy setting is described. (auth)

3531

A HIGH RESOLUTION COINCIDENCE INSTRUMENT WITH SCINTILLATION COUNTERS; DELAYED AND PROMPT COINCIDENCES IN THE DECAY OF ^{181}Hf. H. De Waard. Physica 18, 1151-6(1952) Dec. (In English)

A coincidence instrument constructed around two EMI-5311 photomultipliers and cylindrical stilbene crystals and its performance in measuring prompt coincidence curves are described. The 10^{-8}-sec isomeric state of Ta^{181} was investigated with the instrument; a half life of $1.06 \pm 0.03 \times 10^{-8}$ sec was obtained from the delayed coincidence curve. The decay scheme of Hf^{181} is discussed in the light of these results. (G.Y.)

3532

QUANTITATIVE EVALUATION OF γ-RAY SPECTRA FROM SCINTILLATION MEASUREMENTS. D. Maeder and V. Wintersteiger. Physica 18, 1147-50(1952) Dec. (In English)

The Compton-electron distribution produced by monochromatic γ rays has been calculated for cylindrical NaI crystals of different sizes, secondary absorption being taken into account. The ratio of the apparent photo-peak pulses to the total number of pulses, known as the "effective photo fraction," is plotted as a function of γ-ray energy and crystal size. A correction for backscattering from the Plexiglas light pipe also is considered. (G.Y.)

3533

QUENCHING OF PHOTONS IN ARGON-CO_2 PROPORTIONAL COUNTERS. Laura Colli and Ugo Facchini. Physica 18, 1272-9(1952) Dec. (In English)

The processes governing the formation of pulses in proportional counters filled with pure A and with A-CO_2 mixtures have been studied in detail. The behavior of resonance and metastable levels of the gases is discussed in relation to the quenching cross sections. (G.Y.)

3534

THE EFFICIENCY OF AN IMMERSION COUNTER FOR MEASURING BETA AND GAMMA EMITTERS IN SOLUTION. G. N. Walton. Physica 18, 1280-6(1952) Dec. (In English)

Measurements are reported of the counting efficiency (counts/disintegration/ml) of a glass G-M tube immersed centrally in cylindrical vessels of varying diameter containing solutions of a range of β and β-γ emitters. The effective thickness of the counter wall is estimated, and after allowing for this, a linear relation is established between the β-counting rate from an infinite thickness of liquid and the absorption half-thickness of the β activity measured. The effective wall thickness is also found for the β activity from very thin layers of liquid. The efficiency for counting hard γ activity from thick layers is shown to be proportional approximately to the total photon energy released per disintegration. (auth)

3535

ON THE DETECTION OF HIGH ENERGY PARTICLES WITH A FAST COINCIDENCE SYSTEM. Karl Strauch. Rev. Sci. Instr. 24, 283-9(1953) Apr.

A coincidence system is described that includes a fast diode bridge coincidence circuit. A discussion is given of the properties of such a system that are desired for its use in the detection of particles with a continuous energy spectrum. The adjustment and testing of the system for a given experiment are considered in detail. Finally, the performance of a proton telescope utilizing five fast coincidence channels is described. (auth)

3536

SIMPLE COUNT RATE SYSTEM TO WORK FROM SCALER. Russel M. Ball. Rev. Sci. Instr. 24, 323(1953) Apr.

A count-rate system is described for use with a scaler to give a quick indication of count rates before the final accurate assays. The method chosen was to measure the integrated pulses from the register, the pulses being rectified with a Se voltage-doubler arrangement which required no standby power from the scaler and did not interfere with the register action. The pulse integration was done with a 40-μf electrolytic, and the current was run through a 1-mil meter calibrated from 0 to 2000 cpm. By means of the selector switch on the scaler the full-scale value of the count-rate meter could be changed to 2000, 16,000, 32,000, or 64,000 cpm. (L.M.T.)

3537

INSTRUMENTATION FOR GEOPHYSICAL EXPLORATION. D. H. Clewell, R. A. Broding, G. B. Loper, S. N. Heaps, R. F. Simon, R. L. Mills, and M. B. Dobrin. Rev. Sci. Instr. 24, 243-66(1953) Apr.

A review is presented of instrumentation for geophysical exploration, including reflection seismographs, geophones, seismic amplifiers, seismic cameras, gravity meters, electrical-resistivity well-logging apparatus, magnetometers, and neutron and gamma well-logging apparatus. A discussion of the use of ionization chambers, electrometers, geiger counters, and scintillation counters as detectors with the radioactive well-logging apparatus is presented. (L.M.T.)

3538

INSTRUMENTATION FOR THYROID MEASUREMENT. Gordon L. Brownell and John B. Stanbury. J. Clin. Endocrinol. and Metabolism 13, 210-20(1953) Feb.

The problems of measurement of radioactive I in thyroid study are divided into three parts: absolute measurement, directional counting, and body fluid analysis. The difficulties encountered in each are discussed and typical instrumentation described. It is pointed out that these problems are often not entirely of a physical nature, but may involve physiologic and anatomic considerations. (auth)

3539

USE OF TRACERS IN CHEMICAL DOSIMETRY. Gösta Rudstam and The Svedberg. Nature 171, 648(1953) Apr. 11.

In order to increase the sensitivity of the $FeSO_4$-H_2SO_4 dosimeter, tracer Fe^{59} was added to the solution, and the ferric ions produced by γ irradiation then were measured radiometrically. By changing the concentration of the ferrous salt, radiation dosage in the range 0 to 100 r can be measured with an accuracy of ± 2 r. The suitability of an acid or neutral solution of KI for chemical dosimetry was studied with tracer I^{131}. Very dilute solutions must be used; these do not seem stable enough to be useful as dosimeters. (G.Y.)

3540

ENERGY CALIBRATION OF INSTRUMENTS. Kai Siegbahn. Physica 18, 1043-62(1952) Dec. (In English)

Improvement in the accuracy of nuclear spectrometers is discussed. Numerous spectrometers of various design are mentioned, and some problems, such as the reason for broadening of K conversion lines, now being deciphered with the increased accuracy, are mentioned. (G.Y.)

MESONS

3541

RANGE DISTRIBUTION OF μ-MESONS FROM π-MESON DECAY IN PHOTOGRAPHIC EMULSION. W. F. Fry and George R. White. Phys. Rev. 90, 207-10(1953) Apr. 15.

The lengths of μ-meson tracks from 1000 π-meson decays have been measured in two Ilford C2 200 μ-thick emulsions, which had been exposed in a spiral-orbit spectrometer to the Berkeley cyclotron. Shrinkage factors obtained from this analysis were used to calculate the true ranges of the μ-meson tracks. The distribution of true ranges meets statistical tests for a Gaussian distribution; it has a mean of 597 ±

1 μ and a standard deviation of 29.1 ± 0.7 μ. Since decay in flight and soft-photon emission accompanying decay have negligible effects in this study, the straggling parameter for 4.1-Mev μ mesons in photographic emulsion can be obtained; it is 4.86 ± 0.12%. The effect of experimental uncertainties on these values can be about 0.1%, which is slightly less than the statistical limits imposed by the finite number of events. (auth)

3542

A SEARCH FOR V^0 PARTICLES PRODUCED BY 450-MEV PROTONS. R. L. Garwin. Phys. Rev. 90, 274-8(1953) Apr. 15.

A search was made for high-energy γ rays originating in vacuum close to a target bombarded by 450-Mev protons. The absence of a significant number of such γ's indicates that the cross section per nucleon is less than 7×10^{-33} cm^2 for production of unstable particles which decay into π^0 with a lifetime $\sim 2 \times 10^{-10}$ sec. (auth)

3543

INTERACTIONS OF μ-MESONS. W. D. Walker. Phys. Rev. 90, 234-8(1953) Apr. 15.

The energy spectrum of electrons knocked on by μ mesons has been measured over a wide range of energies. It is found that the theoretical cross section as derived by Bhabha (Proc. Roy. Soc. (London) A164, 275(1938)) fits the data for knock-on energies of a few Mev up to energies of the order of a bev. From these data it is concluded that any particle structure that might exist does not appreciably affect collisions with impact parameters of 6×10^{-13} cm or more. It is found that the theoretical cross section for direct pair production by μ mesons is of the right order of magnitude. From the experiment an upper limit of 2×10^{-29} cm^2/nucleon is set for the cross section for the production by μ mesons of a penetrating secondary of the type originally reported by Braddick and Hensby (Nature 14, 1012(1939)). (auth)

3544

EVIDENCE FOR THE DIRECT PRODUCTION OF κ-MESONS. N. Isachsen, V. Vangen, and S. O. Sörensen. Phil. Mag. (7) 44, 224-7(1953) Feb.

An event bearing on the mode of origin of heavy mesons was recorded in an Ilford G5 emulsion, 400 μ thick, exposed at 90,000 ft. A particle with a total range of 14 mm was ejected from a nuclear disintegration. It came to rest in the emulsion and transformed with the emission of a single charged particle with a velocity closely approaching that of light. The momentum of the secondary particle, which produced a track length 2.5 mm in the emulsion, was ~180 Mev/c, a value considerably greater than the maximum momentum of the electrons formed by the decay of μ mesons. Observations along the meson track showed it to be several times more massive than a μ meson and it is strongly felt that it is a κ or χ particle. (L.M.T.)

3545

PHOTO-ELECTRIC DETERMINATION OF THE MASS OF THE BRISTOL κ_1-MESON. Krister Kristiansson. Phil. Mag. (7) 44, 268-80(1953) Mar.

The track desnity of the Bristol κ_1 meson has been determined photoelectrically. The measurements have been accurately corrected for uneven development and transparency of the emulsion. The mass has been calculated by comparison with tracks which have roughly the same slope as the meson track and also by comparison with a proton track which crosses that of the meson. The result of the mass determination is $m\kappa_1 = 1518 \pm 70\ m_e$. (auth)

METEOROLOGY

3546

New York Univ., Coll. of Engineering

EXPERIMENTAL STUDIES OF SMALL SCALE TURBULENCE: PROGRESS REPORT [FOR] DECEMBER 1, 1950 TO FEBRUARY 28, 1951. James E. Miller, A. K. Blackadar, Bernard Shorr, and David Slade. Feb. 28, 1951. 34p. (ATI-112063; Progress Report 142-03)

MOLECULAR PROPERTIES

3547

Atomic Energy Research Establishment, Harwell, Berks (England)

THE INFRA-RED SPECTRA AND MOLECULAR STRUCTURE OF SOME INORGANIC HEXAFLUORIDES. PART 3. SeF_6 AND TeF_6. J. Gaunt. Mar. 5, 1953. 14p. (AERE-C/R-1124)

The infra-red spectra of SeF_6 and TeF_6 have been reinvestigated in the region 2-25μ. The observed spectra have been interpreted along the lines described in previous reports (see NSA 6-155 and 7-1401) indicating that these molecules also belong to the O_h point group and have totally symmetric octahedral structures. The thermodynamic properties have also been calculated. (auth)

3548

Ames Lab.

AN LCAO MO SELF-CONSISTENT FIELD CALCULATION OF THE GROUND STATE OF H_2O. Frank O. Ellison and Harrison Shull. [Mar. 30, 1953]. 8p. (ISC-329)

Calculations of the ground state of the water molecule utilizing the self-consistent field "molecular orbital" method in the "linear combination of atomic orbitals" approximation are presented for the experimentally observed H-O-H bond angle of 105° and O-H distance of 0.9580 A. (L.T.W.)

3549

Solid-State and Molecular Theory Group, Mass. Inst. of Tech.

ELECTRONIC STRUCTURE OF ATOMS AND MOLECULES. John C. Slater. Feb. 15, 1953. 216p. (NP-4541; Technical Report 3)

This report represents the notes of an advanced course which the writer has offered at M.I.T. during the first semester of the academic year 1952-53. The material presented is not an explanation of molecular structure on the basis of quantum mechanics, but rather an exploration of the methods by which quantum mechanics can hope to solve the problems posed by molecular structure. Only when these methods are better understood, by the study of the sort of simple molecules treated here, can more complicated cases be treated. A bibliography of papers on the theory of the electronic structure of molecules is presented. (auth)

3550

Solid-State and Molecular Theory Group, Mass. Inst. of Tech.

[SOLID-STATE AND MOLECULAR THEORY]; QUARTERLY PROGRESS REPORT. Apr. 15, 1953. 72p. (NP-4551; Quarterly Progress Report 8)

For the work concerned with general problems of molecular theory see NP-4541, "Electronic Structure of Atoms and Molecules," a technical report which covers the notes of an advanced course presented at MIT. The arguments presented previously concerning a simple case of ferromagnetism with the interaction of two electrons in an empty band or two holes in an otherwise filled band are carried considerably farther and presented with more mathematical rigor. In search for an antiferromagnetic model attention is being directed to the linear molecule $(MnOMn)^{++}$ and a spin operator method is presented for setting up all the orthogonal singlets for a 2N electron problem. Additional data are reported on the structure of the H_2O molecule. Calculations of $2Z_p$, the effective nuclear charge for the potential in an atom, are presented for several atoms. Discussions are included concerning (1) the orbital effect in neutron-

electron magnetic scattering, and (2) the connection between the many-electron interaction and the one-electron periodic potential problems. (L.M.T.)

3551

THE VISCOSITY OF HEAVY WATER VAPOUR. J. S. Rowlinson. Physica 19, 303-4(1953) Mar. (In English)

The ratio of the viscosities of D_2O and H_2O vapors have been measured to determine if it varies from that predicted, the square root of the ratio of their molecular weights. As the ratio is close to the theoretical value and much lower than the ratio for the liquid state, it was concluded that the motions of H_2O and D_2O molecules differ in the intermolecular force fields of the liquid. (J.S.R.)

NEUTRONS

3552

THERMAL ENERGY RELAXATION LENGTH OF Ra-Be NEUTRONS IN WATER. Jay Tittman. Phys. Rev. 90, 256-7(1953) Apr. 15.

Measurement of the density of thermal neutrons about a point Ra-Be source in an infinite H_2O medium has been extended to 1 m. The thermal relaxation length is found to be constant at 9.58 ± 0.2 cm over a range in which neutron density changes by 10^5. (auth)

NUCLEAR PHYSICS

3553

Argonne National Lab.

INNER BREMSSTRAHLUNG AND THE MAGNETIC MOMENT OF THE NEUTRINO. E. J. Hellund. Mar. 1953. 2p. (AECU-2526; UAC-734)

Recent measurements on the β spectrum of H^3 establish an upper limit of 250 ev for the neutrino rest mass (Langer and Moffat, Phys. Rev. 88, 689(1952)). It is of some interest to point out that the question of the magnitude of the neutrino rest mass is intimately related to the question of the magnitude of its magnetic moment. During β decay, the neutrino is ejected from the neighborhood of the parent nucleus with a velocity very nearly equal to light velocity. Assuming the particle possesses a finite Pauli magnetic moment, one can calculate the intensity of inner bremsstrahlung (F. Bloch. Phys. Rev. 70, 272(1936)). The result shows that the total intensity is directly proportional to the square of the moment and inversely proportional to the square of the neutrino rest mass. Confirmation of this relation can be obtained also by a purely classical calculation in the manner outlined by Chang and Falkoff (Phys. Rev. 76, 365(1949)). One has only to change the expression for the current density, i.e., $\vec{J} = c\vec{\nabla} \times \vec{M}$ where $\vec{M}$ is the moment density, to make their derivation apply to the neutrino. A polar vector interaction, in an allowed transition, yields the following result for the intensity of neutrino inner bremsstrahlung (integrated over all directions),

$$I(k)\,dk \approx \frac{2\alpha}{\pi}\left(\frac{m}{\mu}\right)^2 g^2 k^2 (W_\nu - k)^2 dk \qquad (1)$$
$$\mu \to 0$$

where α is the fine structure constant, m the electron rest mass, μ the neutrino rest mass, k the photon energy and W_ν the initial neutrino energy measured in units of mc^2, and g is the neutrino moment in Bohr magnetons. The expression must be integrated over the neutrino spectrum corresponding to the probability for emission with energy W_ν. As superimposed on the normal β inner bremsstrahlung, the neutrino spectrum would appear as a spurious "line." Adopting the value 1/5000 Bohr mageton allowed by ionization measurements (Nahmias, Proc. Cambridge Phil. Soc. 31, 99(1935)) and Langer's upper bound for μ, the peak of this line would be about three times as great as the corresponding β inner bremsstrahlung for kinetic energies for both particles of 1 Mev. Identification of the entire inner bremsstrahlung by actual experimental observation as β radiation (Novey, Phys. Rev. 89, 672(1953); Bolgano et al., Phys. Rev. 89, 679(1953)) clearly necessitates the adoption of a smaller value for the upper limit of the neutrino moment, consistent with the limits of experimental error. (Entire report)

3554

THE ATOMIC NUCLEUS AND ITS CONSTITUENTS (6th RUTHERFORD LECTURE). R. E. Peierls. Proc. Phys. Soc. (London) A66, 313-24(1953) Apr. 1.

A brief summary of problems of nuclear forces and related subjects is presented. (G.Y.)

3555

THE PAIRING PROPERTY OF NUCLEAR INTERACTIONS. G. Racah and I. Talmi. Physica 18, 1097-1100(1952) Dec. (In English)

The grouping of nucleons into pairs in the j^n and l^n configurations has been proved previously. The present paper shows that this characteristic is not confined to the ground state nor to the δ potential. (G.Y.)

3556

COMPARISON OF BORN AND HEITLER EXPANSIONS IN A SCATTERING PROBLEM. N. Fukuda, T. Kobayashi, Z. Maki, and M. Sato. Progr. Theoret. Phys. (Japan) 8, 261-2(1952) Aug.

Jost and Pais (Phys. Rev. 82, 840(1951)) compared, for the case of high-energy n-p scattering by a central Yukawa potential, the total cross section σ and the angular ratio $R = d\sigma(180°)/d\sigma(90°)$, obtained from the second Born approximation, with the corresponding correct values computed by Christian and Hart (Phys. Rev. 77, 929(1951)). The agreement was unsatisfactory, the total cross section being considerably greater than the correct one. The results of this example using the damping formalism are presented here, and it is concluded (1) that the damping effect is large, and (?) it plays an important role because it remedies the unreasonable situation which appeared in the Born approximation. (L.M.T.)

3557

CROSS SECTIONS FOR THE FORMATION OF THE COMPOUND NUCLEUS BY CHARGED PARTICLES. Mathew M. Shapiro. Phys. Rev. 90, 171-82(1953) Apr. 15.

Schematic theory is employed to calculate σ_c, the cross section for the formation of the compound nucleus when the incident particle is a proton, deuteron, or α particle. The results are compared with the measured (p,n), (α;n,2n,...) cross sections. These should agree in the medium energy region where there is little competition to neutron emission. The curves for the theoretical cross sections as a function of energy have the same shape as the experimental curves. In many cases the magnitude of the measured cross sections of different isotopes of the same element differ from one another, and hence from schematic theory results, by about a factor of two. Tables based on accurate values of the Coulomb wave functions are given for computing the cross section for formation of the compound nucleus by bombardment with protons and deuterons when the atomic number of the target nucleus exceeds 10, and with α particles when the atomic number of the target nucleus lies between 10 and 30. The tables are applicable over a wide range of nuclear radii. (auth)

NUCLEAR PROPERTIES

3558

Laboratory for Nuclear Science, Mass. Inst. of Tech. SYNCHROTRON GROUP and THEORETICAL GROUP. W. Kraushaar, L. S. Osborne, J. S. Clark, and V. F. Weisskopf. p.58-65 of PROGRESS REPORT [FOR THE PERIOD NOVEMBER 30, 1952 TO FEBRUARY 28, 1953]. Feb. 28, 1953.

8p. (AECU-2494(p.58-65))

A study of odd-odd nuclei was initiated. Assuming a simple model in which the two odd particles alone determine the characteristics of the lowest states, a closed formula was obtained for the relative excitation of the different states. (L.T.W.)

3559

THE FIRST EXCITED STATE OF EVEN-EVEN NUCLEI. P. Preiswerk and P. Stähelin. Physica 18, 1118-19(1952) Dec. (In English)

Energy, spin, and configurations of first excited states are discussed in relation to nuclear shell structure. (G.Y.)

3560

SHELL MODEL AND NUCLEAR STRUCTURE. V. F. Weisskopf. Physica 18, 1083-90(1952) Dec. (In English)

Although the shell model of the nucleus has had unexpected success in predicting nuclear properties, the fundamental reasons for its validity are in the main still unknown. Problems of the forces between the nucleons in the nucleus and of the nuclear structure to which these forces lead are discussed briefly. (G.Y.)

3561

SHELL STRUCTURE OF NUCLEI. I. G. Szamosi. Naturwissenschaften 40, 105(1953) Feb. (In German)

A "meson well" potential is established with which the nucleon configurations and spin-orbit interactions can be investigated quantitatively. A noteworthy distinction is indicated between the wells representing light and heavy nuclei. (G.Y.)

3562

NUCLEAR POLARIZATION OF COBALT 60. E. Ambler, M. A. Grace, H. Halban, N. Kurti, H. Durand, C. E. Johnson, and H. R. Lemmer. Phil. Mag. (7) 44, 216-18(1953) Feb.

An experiment is described whereby the nuclear polarization of Co^{60} was accomplished in a paramagnetic salt, the key to the experiment being the incorporation of Ce as cooling agent in the same crystal as the Co. Twelve crystals were mounted with their crystallographic axes parallel and were magnetized in 25 kϕ at 1°K along a direction in which Ce has a large g value. After demagnetization the polarizing field was applied and while the crystals warmed up to 1°K, the γ-ray intensity in the direction of the polarizing field I(0) and perpendicular to it $I(\pi/2)$ was measured. Values of the anisotropy $\epsilon = [I(\pi/2) - I(0)/I(\pi/2)]$ of up to 50% were observed. (L.M.T.)

3563

THE POLARIZATION OF γ-RADIATION FROM ALIGNED NUCLEI. N. R. Steenberg. Proc. Phys. Soc. (London) A66, 391-8(1953) Apr. 1.

Formulas are derived giving the degree of polarization, and its angular dependence, of γ radiation anisotropically emitted from nuclei aligned at low temperatures. These are in the form of Legendre series limited by the multipole order or nuclear spin. It is shown how the polarization determines the character of the radiation and the sign of the magnetic moment of the oriented nucleus. (auth)

3564

ON THE THEORY OF THE DIRECTIONAL DISTRIBUTION AND THE POLARIZATION OF BETA AND GAMMA RAYS EMITTED BY ORIENTATED NUCLEI. H. A. Tolhoek. Physica 18, 1257-61(1952) Dec. (In English)

Measurements of the radiations of nuclei oriented in external or atomic fields at very low temperatures permit removal of ambiguities in nuclear-spin values, determination of magnetic moments of radioactive nuclei, deduction of multipole order of γ radiation, and determination of the hamiltonion for the β interaction. Some problems involved in such measurements are discussed briefly. (G.Y.)

3565

ON THE β-RAY ANGULAR CORRELATIONS. Masami Yamada and Masato Morita. Progr. Theoret. Phys. (Japan) 8, 431-48(1952) Oct.

The angular distribution functions of β rays that are used to obtain the angular correlation functions are calculated taking into account the effect of the nuclear charge. The calculations are performed up to the second forbidden transitions for each β-decay interaction type of the Fermi theory separately but including the mixture of the nuclear matrix elements. To obtain the angular correlation functions easily in the case of the mixed nuclear matrix elements they are given in considerably simple forms in two interesting cases. In an appendix, transformation coefficients $(j_1 3 m_1 m_2 | j_1 3 j m)$ are given. (auth)

3566

ON THE THEORY OF ANGULAR CORRELATION OF TWO SUCCESSIVE GAMMA QUANTA EMITTED BY ORIENTATED NUCLEI. J. A. M. Cox. Physica 18, 1262-3(1952) Dec. (In English)

An equation for arbitrary multipole radiations of two successive γ quanta emitted by oriented nuclei is obtained with the aid of the algebra of tensor operators developed by Racah. Equations suitable for numerical calculations in the case of two successive dipole radiations and two successive quadrupole radiations are deduced. (G.Y.)

3567

ON THE β-γ ANGULAR CORRELATION OF Sb^{124}. Masato Morita and Masami Yamada. Progr. Theoret. Phys. (Japan) 8, 449-56(1952) Oct.

The β-γ angular correlation of Sb^{124} is investigated taking into account the effect of the coulomb field. It is shown that the linear combination of the three nuclear matrix elements, $\int \beta\alpha$, $\int \beta\sigma \times \gamma$, and β^2_{ij} in the first forbidden tensor interaction of the Fermi theory explains the β decay of Sb^{124} almost completely, and in this case the transition of the nucleus is $3(-) - 2(+) - 0(+)$. (auth)

3568

NUCLEAR RADIOFREQUENCY SPECTRA OF D_2 AND H_2 IN INTERMEDIATE AND STRONG MAGNETIC FIELDS. N. J. Harrick, R. G. Barnes, P. J. Bray, and N. F. Ramsey. Phys. Rev. 90, 260-6(1953) Apr. 15.

The molecular beam apparatus previously described (Kolsky et al., Phys. Rev. 87, 395(1952)) has been improved and has been used to make measurements on the nuclear r-f spectrum of H_2 at intermediate and high magnetic fields. These measurements are the first to provide a test of the theory of molecular H_2 at intermediate magnetic fields and provide a more accurate test of the theory at strong magnetic fields. Agreement of the intermediate field results with the predictions from the high and very low field measurements was found to be within experimental error. The numerical values of the interaction constants c and d occurring in the hamiltonian and the physical quantities that can be calculated therefrom were improved by these measurements. The best values of c and d for H_2, obtained from the intermediate field measurements, are 113,904 ± 30 cps and 57,671 ± 24 cps, respectively. Measurements were also made on the nuclear spectrum of D_2 at a stronger external magnetic field than any used previously. These measurements improved the numerical values of interaction constants for D_2. The best values of c and d for D_2 are 8788 ± 40 cps and 25,237 ± 10 cps, respectively. The comparison of c for H_2 and D_2 indicates that the magnetic shielding of the nuclei should differ in these molecules in accordance with $D_\sigma/H_\sigma = 1.006 \pm 0.005$. 21 references. (auth)

3569

SPIN INTERACTIONS OF ACCELERATED NUCLEI IN MOLECULES. Norman F. Ramsey. Phys. Rev. 90, 232-

3(1953) Apr. 15.

The contributions to the spin-rotational magnetic interaction of a nucleus in a molecule of terms dependent on the acceleration of the nucleus are calculated. One of these arises from the fact that the acceleration in molecules is electrical and the moving nuclear magnetic moment interacts with the electric field. The other is the Thomas precession similar to that which occurs for electrons in atoms. The effects of both centripetal acceleration and zero-point vibration acceleration are considered; the latter produces the largest effect. A general expression for the combined effect of these terms is given. When it is averaged over the zero point vibration of the H_2 and D_2 molecules, the contribution to the spin-rotational interaction constant c is 1059 cps for H_2 and 30.6 cps for D_2. (auth)

3570

NOTE ON THE SATURATION PROPERTIES OF NUCLEAR FORCES. S. Endo and H. Kanazawa. Progr. Theoret. Phys. (Japan) 8, 252-3(1952) Aug.

In this note the saturation properties of nuclear forces are verified, showing that both the spin-parallel nucleus and the neutron cluster are unstable, or at least metastable, from a calculation of their binding energies. (L.M.T.)

3571

POPULATION DISTRIBUTION OF NUCLEI ALIGNED AT LOW TEMPERATURES. N. R. Steenberg. Proc. Phys. Soc. (London) A66, 399-402(1953) Apr. 1.

Population distribution functions are given for four suggested methods of nuclear alignment at low temperatures. They are given for arbitrary temperature and in approximate form valid at high temperatures. It is shown how the approximation is related to the approximate angular distribution of γ radiation. (auth)

3572

ANISOTROPIC ANGULAR DISTRIBUTION OF GAMMA RADIATION EMITTED BY A SOURCE CONTAINING ALIGNED ^{60}Co NUCLEI. O. J. Poppema, J. A. Beun, M. J. Steenland, and C. J. Gorter. Physica 18, 1235-40(1952) Dec. (In English)

The anisotropic angular distribution of the γ radiation from aligned Co^{60} nuclei has been measured as a function of the magnetic temperature T^* of a source consisting of six (Co 1%, Cu 10%, Zn 89%)$(NH_4)_2(SO_4)_2 \cdot 6H_2O$ single crystals. The angular distribution has been determined from $T^* = 0.02$ to $T^* = 0.08°$. The maximum anisotropy at $T^* = 0.02°$ is 30%. The experimental results are in reasonable agreement with the theory if the angle 2α between the two axes of nuclear alignment is assumed to have the value 72°. The scintillation counter device and the counting technique are described briefly. The anisotropy effect does not depend strongly on the amount of Cu used as a cooling agent in the crystals. With 20% Cu a somewhat larger anisotropy could be achieved. (auth)

3573

SOME PROBLEMS ARISING IN NUCLEAR SPECTROSCOPY. M. E. Rose. Physica 18, 1302-3(1952) Dec. (In English)

A very brief summary is presented of the present status of the application of nuclear spectroscopy and related theory to the study of internal-conversion coefficients, β decay, angular correlation, radiative lifetimes, and the Auger effect. (G.Y.)

3574

NUCLEAR ALIGNMENT IN ISOTOPES OF COBALT. M. A. Grace and H. Halban. Physica 18, 1227-34(1952) Dec. (In English)

A significant anisotropy of γ radiation from aligned Co^{60} nuclei has been detected. From the variation of the anisotropy with temperature a value for the magnetic moment can be determined: this is 3.5 ± 0.5 n.m. and is consistent with the Schmidt limit of 3.8 based on nuclear shell-model assignments. Similar investigation of Co^{58} shows that the γ ray cannot be dipole but is probably quadrupole. This would give a value of μ of 3.5, which is smaller than the Schmidt limit of 6.2. (auth)

3575

RELATIVE ABUNDANCES AND NEUTRON CAPTURE CROSS SECTIONS OF THE NEODYMIUM ISOTOPES. W. H. Walker and H. G. Thode. Phys. Rev. 90, 447-8(1953) May 1.

A double-focusing mass spectrometer has been used to determine the relative isotopic abundances of naturally occurring Nd and the relative isotopic neutron-capture cross sections. Allowance for isotope fractionation, an effect which is only noticeable under certain experimental conditions, has been accomplished by an averaging technique. The relative abundances are compared with the results previously published. The relative cross sections are normalized to a value of 48 b for the capture cross section of normal Nd. The resulting isotopic cross sections are in satisfactory agreement with the recently published results of Pomerance (Phys. Rev. 83, 641(1951). (auth)

3576

THE SPINS OF Li^6 AND B^{10} IN THE SHELL MODEL. Nissan Zeldes. Phys. Rev. 90, 416-19(1953) May 1.

The intermediate coupling approximation succeeds in explaining the different spins of Li^6 and B^{10}, where the LS coupling and the jj coupling fail. (auth)

3577

HALF-LIFE OF Pd^{109} AND NEUTRON ACTIVATION CROSS SECTION OF Pd^{102}. W. Wayne Meinke. Phys. Rev. 90, 410-12(1953) May 1.

The half life of Pd^{109} has been determined to be 13.6 ± 0.1 hr by careful decay measurement on a chemically purified fraction of metallic Pd irradiated in a nuclear reactor. From the same irradiation the activation cross section of Pd^{102} was found to be 4.8 b for pile neutrons. This cross section value is based on the literature value (corrected for the new half-life determination) of 11.7 b reported for the thermal neutron activation cross section of Pd^{108}. (auth)

3578

THE NUCLEAR MAGNETIC MOMENT OF ^{57}Fe. R. S. Trenam. Proc. Phys. Soc. (London) A66, 414-15(1953) Apr. 1.

The paramagnetic resonance spectrum of Fe with the isotope Fe^{57} enhanced to about 40% has been examined at 90°K, using ferric potassium selenate alum. An upper limit of 0.05 n.m. was established for the nuclear magnetic moment of Fe^{57}. (G.Y.)

3579

SEPARATION OF THE INTRAMOLECULAR AND INTERMOLECULAR CONTRIBUTIONS TO THE SECOND MOMENT OF THE NUCLEAR MAGNETIC RESONANCE SPECTRUM. E. R. Andrew and R. G. Eades. Proc. Phys. Soc. (London) A66, 415-17(1953) Apr. 1.

The evaluation of molecular structural parameters from the second moment (mean square width) of the nuclear magnetic-resonance spectrum is sometimes impeded by a lack of exact knowledge of the crystal structure at the temperature at which the spectrum is measured. A method by which, in certain cases, the intramolecular contribution may be found without the necessity of knowing the crystal structure at all consists in measuring the second moment for two isotopic species of the same compound; in one species some of the nuclei at resonance are replaced by an isotope of much smaller magnetic moment. The method is demonstrated for benzene, C_6H_6, and 1,3,5-trideuterobenzene, $C_6H_3D_3$. (G.Y.)

3580
THE NUCLEAR ELECTRIC QUADRUPOLE MOMENTS OF COPPER 63, 65. B. Bleaney, K. D. Bowers, and R. S. Trenam. Proc. Phys. Soc. (London) A66, 410-12(1953) Apr. 1.

Paramagnetic resonance measurements on $CuK_2(SO_4)_2 \cdot 6D_2O$ and $La_2Cu_3(NO_3)_{12} \cdot 24D_2O$ resulted in the provisional values -0.15_1 and $-0.14_5 \times 10^{-24}$ cm^2 for the nuclear electric quadrupole moments of Cu^{63} and Cu^{65}, respectively. These values are probably correct to within 20%. (G.Y.)

NUCLEAR REACTORS

3581
Joint Establishment for Nuclear Energy Research (Norway)
CALCULATIONS ON NEUTRON FLUX DISTRIBUTION IN THE JEEP. M. Bogaardt. Nov. 20, 1951. 18p. (JENER-1)

Accurate values of the quantities of the several elements present in the reactor are derived. The most reliable values of the nuclear constants to be used are selected and values of those constants which are not available in declassified literature are estimated. With these data certain important quantities, such as diffusion lengths and slowing-down lengths in the JEEP are computed. A theory, essentially a one-group theory, for the neutron flux distribution based on the concept of "neutron resistance" is developed. The theory is applied both for the complete reactor and for the reactor with heavy H_2O up to about 16 cm below circulation level. For the latter case a comparison with experimental data will be made. Eventually the neutron density in the reactor is estimated as a function of the pile level. (auth)

3582
Joint Establishment for Nuclear Energy Research (Norway)
INSPECTION OF THE RODS IN JEEP DURING THE PERIOD DECEMBER 1–7, 1952. J. Brun. Jan. 31, 1953. 13p. (JENER-14)

Inspection of the rods was carried out indirectly because of their radioactivity. The rods were hoisted from the reactor up into a cylinder made of Pb rings and then transferred to a second cylinder provided with a projection apparatus. The rod was slowly lowered into the cylinder while a projection picture of the rod surface was reflected onto a projection screen. When the whole length of one side of the rod had been seen, it was turned 180° and the other side viewed. It was observed that chiseling off the small pittings on the Al tubes (which was done on the previous inspection, January 1952) was very effective in preventing further corrosion. It was noted that the Al metal surface was clearly more oxidized than at the previous inspection. No new cases of large "corrosion sores" were observed. More corrosion was observed in the central part of the reactor than toward the periphery. In general, the tubes appeared to be in good condition. (L.M.T.)

3583
THE EFFECT OF TURBULENCE ON HEAT TRANSFER IN A PILE WITH A LIQUID REACTANT. Eugene N. Parker. J. Applied Phys. 24, 451-2(1953) Apr.

The spacing of cooling surfaces in a liquid reactant pile is considered in an elementary fashion. The resulting physical picture is that the eddy diffusion of thermal energy, which is enhanced by large free volumes of fluid, does not increase as fast as linearly with the spacing of cooling surfaces. Thus, for a given temperature difference between reactant and coolant, the total heat transfer decreases with increased spacing of the cooling surfaces. This disadvantage of large spacings is to be set off against the advantage of decreased parasitic neutron losses to the coolant. (auth)

NUCLEAR TRANSFORMATION

3584
Argonne National Lab.
RADIOCHEMICAL INVESTIGATION OF THE SPONTANEOUS FISSION OF Cm^{242}. E. P. Steinberg and L. E. Glendenin. Mar. 13, 1953. Decl. May 1, 1953. 8p. (AECD-3520; ANL-OCS-329)

The distribution of mass in the spontaneous fission of Cm^{242} has been investigated by a radiochemical determination of the fission yields of 21 nuclides ranging in mass from 91 to 140. The products of spontaneous fission were isolated by standard radiochemical procedures from a solution of 1.0 to 1.5 mg of 162.5-day Cm^{242} emitting 7.37×10^{12} α dis/min/mg and providing 4.66×10^5 spontaneous fissions/min/mg. Isolations of the elements of interest were carried out after appropriate periods of growth from known amounts of Cm^{242} and the activities observed with an end-window G-M counter mounted inside an anticoincidence shield. Corrections for absorption, scattering, geometry, decay, and fractional saturation were applied to obtain saturation disintegration rates which, with the known fission rate of the source, give the fission yields. (auth)

3585
Purdue Univ.
EXCITATION CURVES OF (ALPHA, NEUTRON) AND (ALPHA, TWO-NEUTRON) REACTIONS IN SILVER^{109} (thesis). Albert Kellogg Stebbins, III. Aug. 1951. 49p. (ATI-117136)

3586
Livermore Research Lab., Calif. Research and Development Co.
THE CROSS SECTION FOR THE REACTION $Al^{27}(\alpha,\alpha 2pn)Na^{24}$ FROM THRESHOLD TO 380 MEV. M. Lindner and R. N. Osborne. Jan. 8, 1953. 13p. (MTA-13)

The cross section-vs.-energy curve for the reaction $Al^{27}(\alpha,\alpha 2pn)Na^{24}$ was determined from threshold to 380 Mev. Considerable precautions were taken to use He ion beams known to be deuteron-free, and an approximate determination was made of the contribution of the $Al^{27}(n,\alpha)Na^{24}$ reaction to the observed yield of Na^{24}. (auth)

3587
ALPHA PARTICLES FROM $^{10}B + D$. P. B. Treacy. Phil. Mag. (7) 44, 325-8(1953) Mar.

Thin targets containing separated B^{10} have been bombarded by deuterons of energies 0.59, 0.78, and 1.07 Mev, and the emitted α particles observed using a differential ionization chamber. Transitions proceeding via the ground state and first excited state of Be^8 have been identified. On the basis of the dispersion theory of Wigner and Eisenbud (Phys. Rev. 72, 29(1947)), the shape of the α-particle spectrum is used to indicate properties of the first excited state of Be^8. (auth)

3588
THE ENERGY OF NUCLEON-NUCLEON COLLISIONS. R. G. Glasser and Marcel Schein. Phys. Rev. 90, 218-21 (1953) Apr. 15.

The problem of determining the energy of the primary particle in a nucleon-nucleon collision at extremely high energies is discussed. A new nomographic method is proposed which is less subject to fluctuations than most estimates used previously. The method allows a redetermination of the energy of the "S" star, which confirms the previous estimate. (auth)

3589
HELIUM 3 REACTIONS IN NUCLEAR PHOTOGRAPHIC EMULSIONS. J. H. Fremlin. Phil Mag. (7) 44, 141-60 (1953) Feb.

An attempt has been made to learn something of the kinds of nuclear reaction undergone by He^3 in the range of energy from 0 to 29 Mev, by examining individual reactions taking

place in nuclear emulsions. About 130,000 tracks produced by 30-Mev He^3 ions accelerated by the Birmingham University cyclotron were examined. Apart from deflections due to collisions with Ag and Br nuclei, 231 nuclear reactions were observed. Half of these represented close elastic collisions with light nuclei, including 102 with H nuclei. Among the others, reactions of the types (He^3, n), (He^3, α), (He^3, d), (He^3, t), (He^3, 2p), (He^3, pn) and (He^3, αp) were definitely identified, while (He^3, 2p2α) and (He^3, αpn) were almost certainly so. (auth)

3590

GAMMA-RAY RESONANCES IN THE ALPHA-PARTICLE BOMBARDMENT OF BERYLLIUM AND BORON. F. L. Talbott and N. P. Heydenburg. Phys. Rev. 90, 186-7(1953) Apr. 15.

Be^9 and B^{10} have been bombarded with α particles from an electrostatic generator at energies up to 3.0 Mev, and the γ-radiation yield has been observed with scintillation counters. The data indicate energy levels in C^{13} at 11.95 and 12.46 Mev and in N^{14} at 12.77, 12.87, 12.90, 13.01, and 13.24 Mev. A number of higher energy levels were indicated in N^{14} but were not satisfactorily resolved. (auth)

3591

HIGH ENERGY GAMMA-GAMMA CROSS SECTION OF In^{115}. J. Goldemberg and L. Katz. Phys. Rev. 90, 308-14(1953) Apr. 15.

Several photonuclear reactions induced in indium by the x rays from a 25-Mev betatron have been measured. Special attention has been given to the reaction $In^{115}(\gamma,\gamma')In^{115*}$. Applying proper corrections, it was found that this reaction has a shape similar to the shape found in the usual photonuclear reactions. This experiment shows that 1 in 7 deexcitations of an excited In nucleus decays by γ emission. The (γ,n) reaction in In^{115} has been measured and was found to have 0.42 Mev-b for the integrated cross section, in good agreement with theoretical predictions. The ratio of the cross sections for production of the isomeric and ground states of In^{114} has also been studied. It was found that transitions to the isomeric state of In^{114} are highly favored, as would be expected from an analysis of the spin changes involved. The cross section for the reaction $In^{115}(\gamma,2n)In^{113*}$ has been measured and the ratio of this cross section to the (γ,n) reaction is compared with that predicted by statistical theory. 24 references. (auth)

3592

ENERGY DEPENDENCE OF THE CROSS SECTION OF THE $Li^7(\gamma,\alpha)H^3$ REACTION. P. Stoll and M. Wächter. Nuovo cimento (9) 10, 347-9(1953) Mar. 1. (In German)

Previous studies of the γ resonance lines and energy levels of Li^7 have been performed with monochromatic γ sources. In the present investigation, Li-loaded Kodak NT1 plates were exposed to a continuous betatron γ spectrum of 15 Mev maximum energy. Analysis of the resulting α and T tracks resulted in a principal maximum cross section of 1.3×10^{-28} cm^2 at E_γ = 7.25 Mev. Two other maxima at 5.25 and 9.25 Mev also were observed. (G.Y.)

3593

NUCLEAR REACTIONS AND RADIOACTIVITIES RESULTING FROM 6.7 MEV ^3H AND 21 MEV ^3He CYCLOTRON BOMBARDMENTS. M. L. Pool. Physica 18, 1304-7(1952) Dec. (In English)

Various reactions produced by H^3 and He^3 ions are tabulated. Relative cross sections are given. Half lives for C^{11} and Zn^{62} activities produced by these reactions were found to be 20.74 ± 0.10 min and 8.4 hr, respectively. The Ga^{65} half life was found to be 15.0 min, ruling out the possible assignment of the latter to Ga^{64}. Investigation of the decay of Ga^{67} disclosed a metastable state in Zn^{67} with the exceptionally long half life of 350 μsec. (G.Y.)

3594

A STUDY OF THE REACTION $^{11}B(d,n)^{12}C$ BY AN IMPROVED PHOTOGRAPHIC METHOD. W. M. Gibson. Phil. Mag. (7) 44, 297-303(1953) Mar.

A way of simplifying the microscope measurements and the resulting calculations, in the photographic-emulsion method of studying neutron spectra, is described. The energy distribution of neutrons from the reaction $B^{10}(d,n)C^{11}$ has been measured, to show that the saving in time is accompanied by no appreciable loss of accuracy. The method has been used in a study of the angular distribution of neutrons from the reaction $B^{11}(d,n)C^{12}$ at 8.1 Mev. The results are consistent with the theory of the stripping process and confirm that the 4.47 Mev level in C^{12}, like the ground state, has even parity. (auth)

3595

THE $Zn^{64}(d,\alpha n)Cu^{61}$ REACTION. C. Sharp Cook and Fred T. Porter. Phys. Rev. 90, 429(1953). May 1.

Relative cross sections for the $Zn^{64}(d,\alpha n)Cu^{61}$ and $Zn^{66}(d,\alpha)Cu^{64}$ reactions have been determined from β-ray data. The ratio of the cross sections for these two reactions is 6.3/100. (auth)

3596

ON THE INTERACTION OF 95-MEV PROTONS WITH D, Li, Be, C, Al, Cu, AND Pb NUCLEI. J. A. Hofmann and K. Strauch. Phys. Rev. 90, 449-60(1953) May 1.

A measurement has been made of the energy distribution of neutrons emitted from various targets at angles of 0, 5, 10, 16, and 28° with respect to the primary 95-Mev proton beam. The results fall into three groups: (1) the number of neutrons emitted by C, Al, Cu, and Pb targets decreases with neutron energy and with angle of emission; (2) the energy distribution of neutrons emitted from D is peaked, but the width is believed to represent mainly the energy distribution of the primary proton beam; (3) neutrons emitted from Li and Be show a peaked energy distribution, with the size of the peak decreasing rapidly with increasing angle of emission. The spectra obtained from the heavier elements appear to be in general agreement with the theory of high-energy nuclear reactions based on the generation of a nuclear cascade. However, the forward minimum and the high-energy peak predicted by Goldberger's calculations have not been observed with the heavier elements. The results obtained with Be are interpreted on the basis of a very simplified model. (auth)

3597

ANGULAR DISTRIBUTION OF THE REACTION $He^3(d,p)He^4$ BETWEEN 240 KEV AND 3.56 MEV. Y. L. Yarnell, R. H. Lovberg, and W. R. Stratton. Phys. Rev. 90, 292-7(1953) Apr. 15.

Monoergic deuterons from an electrostatic generator were used to bombard a thin gaseous target of He^3. Protons formed in the reaction $He^3(c,p)He^4$ were detected outside the reaction chamber by a NaI scintillation counter. The cross section for the reaction $He^3(d,p)He^4$ was measured between the angles of 15 and 130° in the laboratory at deuteron energies at 0.260, 0.455, 0.978, 1.51, 2.01, 2.50, 3.01, and 3.56 Mev. The cross section was measured at a fixed angle of 86° for deuteron energies from 240 to 914 kev. A maximum occurred at a deuteron energy of 430 ± 30 kev. The cross section appears to be isotropic in the c.m. system in the neighborhood of the maximum. The value of the total cross section at the maximum is 0.90 ± 0.10 b. Comparison of this value with the upper bound provided by the single-level dispersion formula indicates that the spin of the compound state of Li^5 formed in the reaction is $^3/_2$. At 978 kev there is a slight angular dependence of the cross section, which becomes more pronounced at higher energies. At 2.50 Mev the cross section displays a minimum at approxi-

mately 113°. At 3.01 Mev the minimum has shifted to 108°, and at 3.56 Mev it appears at 103°. (auth)

PARTICLE ACCELERATORS

3598

Atomic Energy Research Establishment, Harwell, Berks (England)

LINEAR ACCELERATOR WITH SPIRAL ORBITS. J. S. Bell. Jan. 1953. 20p. (AERE-T/R-1093)

Radial stability is obtained in a proton linear accelerator by having the particles perform spiral orbits about a charged axial conductor. The first-order dynamics of the transverse motion is developed. A radial electrostatic field of 50 kv/cm acting on orbits of radius 1.5 cm is suggested for injection at 500 kev into an accelerator with energy gradient 2.3 Mev/meter, vacuum wavelength 1.5 meters, and synchronous phase angle 30°. The field required is higher at shorter wavelength and lower at greater injection energy. The possibility of azimuthal, as well as radial, focusing is considered and this leads to a method identical in principle with the so-called "strong focusing" of Livingstone, Courant, and Snyder. (auth)

3599

Radiation Lab., Univ. of Calif., Berkeley

AN ION SOURCE FOR THE 184-INCH SYNCHROCYCLOTRON. Warren Fenton Stubbins. Jan. 23, 1953. 12p. (UCRL-2078)

An ion source with dee extensions is proposed for the 184-in. synchrocyclotron. An analysis of the source was made on a differential analyzer using electrolytic-tank measurements to obtain electric-field inputs. Protons can be accelerated from the source into orbits of little radial oscillation using the close spacings proposed and 20-kv r-f on the driven dee. The source is suitable for heavier particles. (auth)

3600

Radiation Lab., Univ. of Calif., Berkeley

SUMMARY OF RESEARCH PROGRESS MEETING OF DECEMBER 11 AND 18, 1952. Sergey Shewchuck. Mar. 11, 1953. 10p. (UCRL-2121)

I. Bevatron Progress. W. Brobeck. Design and installation of the bevatron magnet are discussed. It is expected that the bevatron will be assembled in operating order by about Oct., 1953. II. 184-in. Cyclotron Modification Plans. M. Martin. Increasing the energy of the 184-in. cyclotron by increasing the magnetic field and by devising an oscillator and resonator combination for the required frequency swing is being studied. Proposed magnet changes consist of decreasing the gap from 18 to 12 in. by adding extra pole pieces and auxiliary coils. The problem of the required frequency swing is discussed. III. Strong Focusing in the 32-Mev Linear Accelerator. C. S. Nunan. The main purpose for using the strong-focusing principle in the linear accelerator is to increase the beam intensity by eliminating grids and/or foils. In the 32-Mev accelerator the intensity can be increased by a factor of 4. The hyperbolic shape and arrangement of the electrodes is shown, together with the respective curves for the focusing and defocusing characteristics of the beam. Various focusing tendencies of the beam at different conditions of incident phase angle are shown. A force plot illustrates the relative regions of stability between focusing and defocusing. (L.T.W.)

3601

THE CHARACTERISTICS OF THE SYNCHROTRON BEAM. Morton Camac. Rev. Sci. Instr. 24, 290-7(1953) Apr.

Measurements were made on the characteristics of the synchrotron electron beam at the time of the target irradiation. The orbit of the beam expanded from its synchronous accelerating orbit and irradiated individually a variety of copper targets. There were two sets of measurements. In the first the bremsstrahlung beam intensity was measured. From these data the average number of beam traversals of each target was calculated. In the second set the target was removed from the vacuum system after a bombardment and cut into sections. The induced radioactivity of the individual pieces was measured. Information was obtained on the radial penetration of the target and the radial and vertical oscillations of the beam both before and after the target irradiation. The width of the synchrotron beam was 0.1 inch vertically and 0.14 inch radially. The radial penetration of the target by the primary beam decreased almost exponentially with the intensity, dropping by a factor of 2 in about 0.0025 inch. (auth)

RADIATION ABSORPTION AND SCATTERING

3602

RAND Corp.

GAMMA-RAY TRANSMISSION THROUGH FINITE SLABS. G. H. Peebles. Dec. 1, 1952. 203p. (R-240(RAND))

The quantity which is considered as of first importance is the build-up factor for a monoenergetic, monoangular beam of photons incident on a slab of finite thickness but infinite extent. This quantity is obtained for a set of discrete values of slab thickness, of incident energy, and of incident angle. Slab thickness, in mean free paths, spans the interval 0 to 20; incident energy, in units of mc^2, the interval 1 to 20; and incident angle, the interval 0 to 90. Two materials are used for the slab—Pb and Fe. The processes used to obtain the set of build-up factors and to establish their accuracy within reasonable limits are such that a considerable amount of supplementary information is produced. This information is also presented. The supplementary results consist in the probabilities and expected energies corresponding to the transmission of photons with exactly one, two, or three scatterings; distributions of the transmitted photons over energy and angle; some results for slabs of air and of the pure Compton scatterer; some build-up factors in an energy range just below that stated above; photon and energy densities for three source configurations; and other quantities which on occasion might prove interesting or useful. Also, a discussion of the effect of variation of the total absorption coefficient on transmission probabilities is given which leads to estimates of build-up factors for a material of arbitrary atomic number Z. (auth)

3603

Radiation Lab., Univ. of Calif., Berkeley

A HIGH-PRESSURE CLOUD-CHAMBER INVESTIGATION OF PROTONS SCATTERED BY 300 MEV NEUTRONS (thesis). John De Pangher, Jr. Mar. 17, 1953. 80p. (UCRL-2153)

An investigation of the protons scattered by 300-Mev neutrons has been conducted with a Wilson cloud chamber filled with H_2 at a gas pressure of 10 atm. The data obtained covers the range of angles 10 to 180° for the neutrons in the c.m. system. A striking deviation from theoretical predictions occurs for small neutron-scatter angles. The energy spectrum is presented for the neutrons which are produced in a 1-¾-in.-thick LiD target by 340-Mev protons. A few cases of meson production are noted. (auth)

3604

ABSORPTION COEFFICIENTS OF GAMMA-RAYS WITH ENERGIES BETWEEN 0.3 AND 1.5 MEV. S. J. Wyard. Proc. Phys. Soc. (London) A66, 382-90(1953) Apr. 1.

Accurate measurements have been made of the absorption coefficients of γ rays covering the range of quantum energy from 0.3 to 1.5 Mev and of atomic number from 6 to 92. The results verify the Klein–Nishina formula over the whole range of quantum energy. They confirm the calcula-

tions of Hulme and coworkers for the photoelectric coefficient at 0.3 Mev, but disagree with them at higher energies. Some improvements have been made in the method of measuring absorption coefficients, and certain errors, previously overlooked, have been noted and corrected. (auth)

3605

THE MULTIPLE SCATTERING OF PROTONS IN THIN FOILS. D. M. Skyrme. Phil. Mag. (7) 44, 191-203(1953) Feb.

The multiple scattering of 147-Mev protons in thin foils has been investigated using Pt, Ag, and photographic emulsion as the scattering materials. The projected mean scattering angles and the shape of the projected angular scattering distributions agree with the multiple-scattering theory of Williams as modified by Voyvodic and Pickup. 18 references. (auth)

3606

TOTAL COMPTON AND PAIR PRODUCTION CROSS SECTIONS AT 19.5 MEV. Arthur I. Berman. Phys. Rev. 90, 210-17(1953) Apr. 15.

Total cross sections of 19 elements were measured at 19.5 Mev by the photonuclear detector method. The penetration of betatron bremsstrahlung (maximum energy, 20.4 Mev) through the absorbers was determined by the $C^{12}(\gamma,n)C^{11}$ reaction (threshold, 18.7 Mev) in polyethylene. Simultaneously operated monitor-detector Geiger units, which canceled timing and intensity-fluctuation errors, recorded the C^{11} activity. Percent standard deviations averaged 0.6 for most elements; the estimated systematic error was 0.4%. The narrow-energy band width permitted an accurate calculation of the correction for the proportion of counts due to secondary radiation. From the absorption data a value of the Compton cross section was determined. The integrated Klein-Nishina result fell within the 2% experimental error calculated by adding linearly to the statistical errors, an estimated 50% uncertainty in the published photonuclear cross sections employed in the determination. The cross sections for pair production found from the experiment σ_e, are related to the theoretical values σ_t, as derived by the Born approximation (Bethe-Heitler formula including screening), by $(\sigma_t - \sigma_e)/\sigma_t = (1.55 \pm 0.1) \times 10^{-5} Z^2$, to a first approximation. (auth)

3607

THE RANGE ENERGY RELATION FOR PROTONS OF INTERMEDIATE ENERGY IN AIR. W. E. Burcham. Phil. Mag. (7) 44, 211-13(1953) Feb.

While it is known that the stopping-power formula works well for protons below 2 Mev, it was thought of interest to see to what extent the higher-energy part of the range-energy curve (up to 12 Mev) receives experimental verification. This was done by comparing the ranges of groups of protons observed in (d,p) reactions with the values predicted from the accepted range-energy curve, using energies calculated from accurately determined Q values. Results show that the range-energy relation given by Livingston and Bethe (Revs. Mod. Phys. 9, 245(1937)) is fairly well verified. (L.M.T.)

3608

THE CROSS SECTION FOR STAR PRODUCTION IN NUCLEAR EMULSIONS BY 130 MEV PROTONS. C. F. Lees, G. C. Morrison, H. Muirhead, and W. G. V. Rosser. Phil. Mag. (7) 44, 304-12(1953) Mar. (cf. NSA 7-1826).

Methods are described whereby stars produced in nuclear emulsions by protons, in the energy range 110 to 146 Mev may be separated into disintegrations produced in the light (C, N, and O), and heavy (Ag and Br) components of the emulsion. The cross sections obtained for nuclear disintegrations are compared with those predicted by the transparent-nucleus theory of Fernbach, Serber and Taylor (Phys. Rev. 75, 1352(1949)). (auth)

3609

THE EFFECT OF DAMPING ON RADIATIVE CORRECTIONS TO ELECTRON SCATTERING AND THE PROBLEM OF INFRA-RED CATASTROPHE. R. C. Majumdar and A. N. Mitra. Progr. Theoret. Phys. (Japan) 8, 479-92 (1952) Oct.

The reaction of radiation on the scattering of electrons with radiative corrections is treated on the basis of covariant theory of radiation damping. It is shown that the ultraviolet divergences are removed by the process of usual mass and charge renormalizations; and the infrared divergence, which still persists in the second-order corrections to radiationless electron scattering is exactly compensated by the corresponding divergence occurring in the scattering with the emission of radiation. The interaction hamiltonian for the scattering processes after Feynman-Dyson formalism, the covariant formulation of radiation damping, and the scattering cross sections are given. The infrared divergences involved in the electron scattering are discussed. (auth)

3610

EFFECTS OF TENSOR FORCES ON THE NEUTRON-DEUTERON SCATTERING. Hisashi Horie, Taro Tamura, and Shiro Yoshida. Prog. Theoret. Phys. (Japan) 8, 341-54(1953) Sept. (cf. NSA 6-4645).

The elastic n-d scattering cross section at 90 Mev is calculated, using the Born approximation. For n-n and n-p interactions we adopt the potentials which give good agreement with nucleon-nucleon scattering experiments at high energies. The Hulthén wave function is used as the ground-state wave function of the deuteron. The results are in better agreement with experiments than the calculations which do not take into account the tensor forces. (auth)

3611

ELASTIC SCATTERING AND NEUTRALIZATION OF LOW VELOCITY HYDROGEN IONS IN METHFORANE AND ETHFORANE. J. H. Simons and C. S. Garber. J. Chem. Phys. 21, 689-92(1953) Apr.

The low-velocity scattering of H^+, H_2^+, and H_3^+ in both methforane (CF_4) and ethforane (C_2F_6) has been measured at ion velocities of less than 150 v. Ion neutralization was detected and measured for all three ions in both fluorocarbons, and elastic scattering potential function were evaluated for all six interactions. These measurements are compared with similar ones made on the hydrocarbons methane and ethane. (auth)

3612

INELASTIC NUCLEAR SCATTERING OF PHOTONS BY Rh^{103}. Carlos Sánchez del Río y Sierra and Valentine L. Telegdi. Phys. Rev. 90, 439-42(1953) May 1.

A lower limit to the inelastic nuclear photon-scattering cross section of Rh^{103} was determined as a function of energy. Rh foils were exposed to a bremsstrahlung beam and the yield of $Rh^{103}(\gamma,\gamma')Rh^{103m}$ was measured as a function of the upper limit of the spectrum. Activities were counted with a windowless 4π proportional counter and $Ta^{181}(\gamma,n)Ta^{180}$ was used as a monitor above 8 Mev, adopting the improved results of the Sasketchewan group. It was ascertained that the fast-neutron contamination of the beam contributed but a small fraction of Rh^{103m} activity. The cross section, obtained from the yield curve by customary methods, is found to go through a peak of the order of 10 mb at about 13 Mev and to be appreciable below the $Rh^{103}(\gamma,n)Rh^{102}$ threshold (9.35 Mev). The observed location of the peak is considerably lower than would be expected for $Rh^{103}(\gamma,n)$ from the empirical A dependence of (γ,n) cross sections, and is also at variance with the observations of Katz and Cameron on $Au^{197}(\gamma,\gamma')Au^{197}$, but appears plausible on theoretical grounds as does the magnitude of the cross section. (auth)

RADIATION EFFECTS

3613
Sarah Mellon Scaife Radiation Lab., Univ. of Pittsburgh
RADIATION DAMAGE STUDY; REPORT FOR AUGUST AND SEPTEMBER 1952. 8p. (NP-4533; Report 3)

Methods of measurement of the dosage given to samples bombarded in the cyclotron were investigated and it was concluded that the darkening of glass is not a promising method of measuring radiation dosage. The use of a special water baffle containing an ionization chamber was also found to be unsatisfactory. Devices are described which were designed for bombarding oils and refrigerants in the cyclotron. (For previous report in series see NP-4443.) (C.H.)

3614
Sarah Mellon Scaife Radiation Lab., Univ. of Pittsburgh
RADIATION DAMAGE STUDY; REPORT [FOR] JUNE [AND] JULY 1952. 12p. (NP-4534; Report 2)

The effects of radiation on the hardness and tensile strength of silastics are briefly reported. A device for irradiating O rings under mechanical stress is described. (J.E.D.)

3615
THE DECAY IN FLUORESCENCE EFFICIENCY OF ORGANIC MATERIALS ON IRRADIATION BY PARTICLES AND PHOTONS. F. A. Black. Phil. Mag. (7) 44, 263-7 (1953) Mar.

Measurements have been made of the damage caused by α-particle irradiation of several materials; some results are given for electron and ultraviolet irradiation. A comparison of the fluorescence efficiency for α-particle and electron excitation for these materials is made. The implication of the results is discussed in some detail, and analysis leads to a new understanding of the abnormally low α-particle fluorescence yield in organic materials. (auth)

RADIOACTIVITY

3616
RADIOACTIVITY OF Pt^{191} AND Pt^{193m}. J. B. Swan, W. M. Portnoy, and R. D. Hill. Phys. Rev. 90, 257-8(1953) Apr. 15.

A 3.2-day activity of Pt^{191} and a 4.5-day activity of Pt^{193} have been investigated. Electron capture of Pt^{191} is followed by a complex spectrum of γ radiation. The 4.5-day Pt^{193m} activity is a characteristic M4 isomeric transition of 135 kev. (auth)

3617
GAMMA-RAYS FROM Mg^{26}. John E. May and Bruce P. Foster. Phys. Rev. 90, 243-7(1953) Apr. 15.

The energies of the γ rays found in coincidence with the protons of the $Na^{23}(\alpha,p)Mg^{26}$ reaction have been measured with a NaI(Tl) scintillation counter. The experiments revealed doubt as to the existence of an excited state at 0.4 Mev. A direct transition to ground was found from the 1.83-Mev excited state. Competition between a cascade transition to the 1.83-Mev excited state and a weaker crossover transition to ground was observed for the 2.97-Mev excited state. With the 3.97-Mev excited state were identified a cascade transition to the 1.83-Mev excited state and a probable crossover transition to the ground state. For the decay of the 4.35-Mev excited state, a 1.38-Mev transition to the 2.97-Mev excited state was established. There is also a discussion of possible spin and parity assignments and a few decay schemes proposed by the use of the Weisskopf lifetime formulas. (auth)

3618
A SEARCH FOR SHORT-LIVED NUCLEAR ISOMERS. Theodore C. Engelder. Phys. Rev. 90, 259-60(1953) Apr. 15.

A search for short-lived isomeric transitions has been initiated. Using a delayed-coincidence apparatus having an over-all resolution of 2×10^{-9} sec, sixteen γ transitions were investigated for half lives in the 2×10^{-9} to 10^{-7} sec range. Metastable states in K^{41}, 1.3 Mev above ground and in Ta^{181}, 471 kev above ground were verified, while the remaining transitions were found to have half lives less than 2×10^{-9} sec. Weisskopf's formula relating spin change and half life, together with internal conversion information, were applied to these data, and definite spin changes were assigned to five of the transitions. (auth)

3619
ELECTROMAGNETIC SPECTRUM OF RADIUM D. P. E. Damon and R. R. Edwards. Phys. Rev. 90, 280-4(1953) Apr. 15.

The electromagnetic spectrum of RaD(Pb^{210}) has been studied by the proportional counter spectrometry technique. The work of the Curie Laboratory on the γ-ray spectrum has been generally confirmed. However, the presumed K x-ray lines are of much lower intensity and occur at a lower energy than previously reported. The L x-ray intensity is 22 per hundred disintegrations, indicating 0.63 conversion per disintegration and a conversion coefficient of 18.3 for the principal γ ray. 23 references. (auth)

3620
INTERNAL PAIRS IN ANISOTROPIC EMISSION. G. Goldring. Proc. Phys. Soc. (London) A66, 341-5(1953) Apr. 1.

The angular correlation of internally converted pairs is investigated for cases in which the γ rays are emitted anisotropically. Interference between electric and magnetic multipoles is considered. (auth)

3621
ON A NEW SELECTION RULE FOR CERTAIN β DISINTEGRATIONS. M. Trocheris. Physica 18, 1094-6(1952) Dec. (In French)

Forbiddenness due to change of state of more than one nuclear particle is discussed, particularly for the cases Zr^{89m}, Y^{87}, and Cd^{115m}. (G.Y.)

3622
MATRIX ELEMENTS FOR MIRROR TRANSITIONS. Aage Winther. Physica 18, 1079-82(1952) Dec. (In English)

Investigations on the shell-model prediction of matrix elements for β transitions between mirror nuclei are reported. The results extend those reported previously (NSA 6-4254). (G.Y.)

3623
BETA DECAY AND BINDING ENERGY OF THE ELECTRON SHELLS; PRIMARY β SPECTRUM OF RaD. E. Huster. Naturwissenschaften 40, 197-8(1953) Mar. (In German)

In β^- decay the binding energy of the electron shells increases by $\Delta E_H = E(Z+1) - E(Z)$. Several hypotheses as to how this energy increase is given up are available. Studies on RaD (Pb^{210}) show that ΔE_H is emitted together with the nuclear energy differences and is divided between the electron and the neutrino. A maximum energy of 24.2 ± 2.5 kev was found for the β spectrum of RaD, a value not in agreement with those reported in the literature. The existence of β emitters with $E_{max} < \Delta E_H$ should be possible, in which case the bare nucleus would be β stable; Pu^{241} is perhaps such a case. (G.Y.)

3624
ON THE THEORIES OF ANGULAR DISTRIBUTION AND CORRELATION OF BETA AND GAMMA RADIATION. S. R. De Groot. Physica 18, 1200-14(1952) Dec. (In English)

In both angular-distribution and angular-correlation phenomena nuclear radiation arises from ensembles of nuclei with an unequal population of magnetic sub-levels. This population is described by appropriate "orientation parameters." On this basis, the theories of the directional as well as the polarization aspects of angular distribution

and correlation are reviewed. Special attention is paid to the quantum-mechanical description of polarization by means of statistical matrix elements and Stokes parameters. Results and examples are considered, especially of the distribution of γ and β rays, and the correlation of γ-γ, β-γ, and β-neutrino radiation. (auth)

3625

NUCLEAR RECOIL AND DETECTION OF THE NEUTRINO. O. Kofoed-Hansen. Physica 18, 1287-1301(1952) Dec. (In English)

A summary of β-recoil experiments in which an energy determination has been attempted is presented. Experiments where merely recoil-efficiencies have been determined are not considered. The investigations are divided into experiments with K-capture processes and experiments on β-decay processes. The main features of the $\pi \rightarrow \mu$ and $\mu \rightarrow e + 2\nu$ processes are summarized. The present situation as regards neutrino absorption experiments is reviewed. 46 references. (G.Y.)

3626

ELECTROMAGNETIC RADIATION FROM RADIUM E. D. G. E. Martin and G. Parry. Phil. Mag. (7) 44, 344-6(1953) Mar.

A scintillation spectrometer was used to study the electromagnetic radiation from a RaE source, to determine if a monochromatic line exists in the region of 85 kev. It appears that the intensity of such radiation is not greater than 1 quantum per 6000 β disintegrations. The number of γ quanta in the bremsstrahlung above 90 kev is estimated to be 2.5×10^{-3} per disintegration. (auth)

3627

DECAY OF ^{198}Au. Lennart Simons. Physica 18, 1250-2 (1952) Dec. (In English)

A β spectrum with a maximum energy of 0.965 Mev has been obtained with neutron-irradiated Au in a double-focusing magnetic spectrograph of the Siegbahn type. The probable decay scheme is presented. A spin of 2 is indicated for the Hg^{198} 0.411-Mev level. The ground state of Au^{198} is either 3 or 1, the former being more probable. (G.Y.)

3628

AUGER LINES IN THE BETA-SPECTRA OF UX AND As. P. H. Stoker and Ong Ping Hok. Physica 18, 1253-6(1952) Dec. (In English)

Low-energy electron lines were found in the UX_1 (Th^{234}) + UX_2 (Pa^{234}) and As^{71} β spectra by the use of a double-focusing spectrometer. The lines have been assigned to K and L Auger transitions. (G.Y.)

3629

THE DECAY SCHEME OF RaC. A. H. Wapstra. Physica 18, 1247-9(1952) Dec. (In English)

Coincidence-absorption experiments on RaC (Bi^{214}) decay with a common β-γ coincidence arrangement using G-M counters indicate that the 3.17-Mev β transition goes to the RaC′ (Po^{214}) ground state. The first Po^{214} excited state is then the 608-kev state. The whole absorption curve can be described by two components: ~3 Mev in 19% abundance and 1.55 Mev in 81% abundance. (G.Y.)

3630

AN INVESTIGATION OF THE RaC GAMMA-RAYS FROM THEIR COMPTON SECONDARIES. M. Mladjenović and A. Hedgran. Physica 18, 1242-6(1952) Dec. (In English)

For examination of very complex γ spectra, utilization of "Compton lines" obtained when the collimated γ rays expel Compton electrons from a thin radiator into a narrow acceptance aperture of a spectrometer is advantageous in that the intense Compton background encountered with the usual photoelectron spectrum method is avoided. The RaC (Bi^{214}) spectrum was studied by Latyshev et al. (Zhur. Fiz. U.S.S.R. 3, 251(1940)) using the Compton line method. The present repetition of this experiment, combined with a comparison with the more precise photo spectra, has presented evidence for the following additional RaC γ transitions: 0.697, 1.504, 1.630, 1.671, 1.728, 1.838, 2.109, and 2.4 Mev. (G.Y.)

3631

POSSIBLE EXPLANATION OF THE RADIOACTIVITY INDUCED BY THE DETONATION OF SHAPED CHARGES. L. Grunberg and K. H. R. Wright. J. Chem. Phys. 21, 763(1953) Apr.

H_2O_2 is formed during the oxidation of freshly exposed metal surfaces (produced either by abrasion or evaporation of the metal) in the presence of water vapor. This can subsequently give rise to a pseudophotographic effect, if the exposed metal surface is placed in close proximity to a photographic plate. This may be the explanation of Fonberg's (see NSA 5-5896) apparent observation of radioactivity induced in splinters resulting from the action of shaped-charge detonations on metal plates. Hot or freshly abraded splinters also can give spurious counts in G-M tubes. (G.Y.)

3632

THE RADIOACTIVE DECAY OF Cs^{134}, Os^{185}, Os^{191}, AND Os^{193}. J. M. Cork, J. M. LeBlanc, W. H. Nester, D. W. Martin, and M. K. Brice. Phys. Rev. 90, 444-7(1953) May 1.

From sources of Cs of high specific activity produced in the reactor and studied in photographic magnetic spectrometers, nineteen electron conversion lines are observed. These are interpreted to show the existence of eleven γ rays, four of which have not been previously reported. Certain K/L ratios are measured and the resolution of the components of the β radiation presented. A plausible decay scheme consisting of seven levels in the resultant Ba^{134} nucleus is offered. By irradiating Os sources for various periods in the reactor and obtaining successive exposures in magnetic spectrometers, it is possible to determine the energy and half life of each electron conversion line. Os^{185} decays by K capture with a half life of 96 days. Four γ rays are associated with this activity. Os^{191} decays by a 14-hr isomeric transition followed by β emission with 15-day half life. Two γ transitions in sequence follow the β decay. Os^{193} is a β emitter with a 31-hr half life. Some eighteen electron conversion lines are observed which indicate the presence of nine γ rays, only three of which had been previously observed. (auth)

3633

THE BETA-RAY SPECTRUM OF ^{71}ARSENIC. P. H. Stoker and Ong Ping Hok. Physica 19, 279-86(1953) Mar. (In English)

The activity of As^{71}, obtained by bombarding Ge with deuterons of 26 and 14 Mev has been investigated. From the decay of the electron line of 163.9 kev the half life was found to be 59.5 ± 2 hrs. The 175-kev γ-ray gave the ratio $e_K/e_{L+M} = 8.3$. The Fermi-Kurie plot of the positron spectrum allowed two interpretations, a simple spectrum with endpoint at 800 kev or a complex one with endpoints at 675 and 850 kev. The two corresponding decay schemes are discussed. Four new electron lines were detected, which were ascribed to L- and M-conversion lines of a 13 kev γ ray from As^{73}, and to K→L,L and K→L,M Auger lines. (auth)

3634

CERTAIN EFFECTS OF THE ELECTRON CORTEGE IN β DISINTEGRATIONS AND e CAPTURE. P. Benoist-Gueutal. Physica 18, 1192-200(1952) Dec. (In French)

Modifications in shapes of electron-capture and β-decay spectra caused by the presence of the atomic electron shells are discussed. (G.Y.)

3635
THE STRENGTH OF ELECTRIC DIPOLE RADIATION. B. B. Kinsey and G. A. Bartholomew. Physica 18, 1112-17 (1952) Dec. (In English)

The intensities of the γ rays produced in direct transitions to the ground states of even-charge nuclei are discussed in relation to the neutron number of the product nuclei. The pattern of the spectrum observed when these γ rays are weak is discussed. From these observations it is shown that the probability of emission of electric dipole (E1) radiation near 7 Mev is greater than that of higher electric multipoles and probably also greater than that of magnetic dipole (M1) radiation. The γ rays emitted by odd-charge nuclei also are considered. (G.Y.)

3636
THE HALF-LIFE OF I^{131}. H. H. Seliger, L. Cavallo, and S. V. Culpepper. Phys. Rev. 90, 443(1953) May 1.

An accurate determination of the half life of I^{131} gives the value $8.07_5 \pm 0.02_2$ days. (auth)

3637
K CAPTURE/β^+ EMISSION BRANCHING RATIO. R. Bouchez. Physica 18, 1171-91(1952) Dec. (In French)

Methods for determination of the ratio P_K/P_+, in particular those analyzing the Auger electrons and annihilation photons, are discussed. The recently developed scintillation counter technique is very suitable for low (~1%) proportions of positrons. The P_K/P_+ ratios predicted by the theory of β decay (tensor T interaction) are given for the different ΔJ and ΔL values occurring during the transition; the S (or V) + T (or A) interaction hybrid modifies only the $\Delta J = \Delta L$ transitions, of which type no β^+ or K transitions are known. Experimental results are compared with those given by the theory. For permitted transitions (Ni^{57}, Cu^{61}, Cu^{64}, Cd^{107}, Sn^{111}) the agreement (~20%) permits assignment of an upper limit of 10 to 25% for the hybrid SV or TA terms. For forbidden transitions (Co^{58}, V^{48}, Na^{22}, Zn^{65}), the improvement of the precision of the experimental results permits, in conjunction with the shape of the spectrum, assignment of the order of the transition (ΔJ, ΔL) and the configurations of the nuclear states. (tr-auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

3638
THE SPECTRUM OF GADOLINIUM II. Nissan Zeldes. Phys. Rev. 90, 413-15(1953) May 1.

A comparison was made between theory and experimental data for the spectrum of Gd II. All barycenters of the terms fit very well to the theoretical formulas, but the calculation of the Landé g factors shows deviations from LS behavior. (auth)

SPECTROSCOPY

3639
ANOMALY OF THE $M_{IV,V}$ ABSORPTION IN HEAVY ELEMENTS. J. Friedel. Proc. Phys. Soc. (London) A66, 333-9(1953) Apr. 1.

The final state of the observed $M_{IV,V}$ absorption edge in heavy elements has a higher energy than the other (K, L, M) absorption edges. As suggested by Cauchois, this must be because, owing to selection rules, the transition probability of a 3d electron to the top of the conduction band is very small, and a strong absorption begins only when the ejected electron reaches the bottom of the 5f band. The corresponding energy is computed by the Wigner–Seitz method, and is in satisfactory agreement with the experimental data for the anomaly. As the anomaly disappears for the elements Ra to U, the conduction band of these elements must contain a proportion of 5f states. An anomaly of the same type is to be expected for the 4f band in the second long period, and actually seems to be observed. (auth)

THEORETICAL PHYSICS

3640
Harvard Univ.
THE THEORY OF QUANTIZED FIELDS. II. Julian Schwinger. [1951]. 47p. (NP-4494)

The arguments leading to the formulation of the action principle for a general field are presented. In association with the complete reduction of all numerical matrices into symmetrical and antisymmetrical parts, the general field is decomposed into two sets, which are identified with Bose-Einstein and Fermi-Dirac fields. The spin restriction on the two kinds of fields is inferred from the time-reflection invariance requirement. The consistency of the theory is verified in terms of a criterion involving the various generators of infinitesimal transformations. Following a discussion of charged fields, the electromagnetic field is introduced to satisfy the postulate of general gage invariance. As an aspect of the latter, it is recognized that the electromagnetic field and charged fields are not kinematically independent. After a discussion of the field-strength commutation relations, the independent dynamical variables of the electromagnetic field are exhibited in terms of a special gage. (auth)

3641
ON LAGRANGIAN FORMALISM. Kazuhiko Nishijima. Progr. Theoret. Phys. (Japan) 8, 401-15(1952) Oct.

The differences between lagrangian and hamiltonian formalisms are discussed through the concept of chronological ordering operators, thereby keeping close correspondence to Feynman's path integral. Next a method to derive commutation relations without referring to hamiltonian formalism is presented. (auth)

3642
ON THE INTERACTION REPRESENTATION. Y. Takahashi and H. Umezawa. Progr. Theoret. Phys. (Japan) 8, 493-4 (1952) Oct.

In the theory of the interaction representation (Tomonaga, Progr. Theoret. Phys. (Japan) 1, 27(1946)) the dominant roles are played by the covariant commutation relation of the free field based on the Jordan-Pauli method (Z. Physik 47, 151(1928)) and the interaction hamiltonian determining the motion of the state vector and the unitary transformation which connects the free equation of motion and one in the Heisenberg representation. In this note the methods of obtaining the covariant commutation relation of the free field and the correct interaction hamiltonian and the general formalism of the interaction representation based on those methods are discussed briefly. (auth)

3643
TOMONAGA APPROXIMATION IN MESON THEORY. H. Hasegawa. Progr. Theoret. Phys. (Japan) 8, 494-6 (1952) Oct.

It is suggested that despite the success of perturbation and strong-coupling theories in describing the meson-nucleon interaction, the coupling may not be extremely large but may lie in the "intermediate" region. Tomonaga proposed a method of approximation for this region and showed that for two limiting cases results agree with those from conventional theory. In this note the Tomonaga approximation is applied to neutral, charged, and symmetrical scalar and pseudoscalar mesons. (L.M.T.)

3644
A GENERALIZED METHOD OF FIELD QUANTIZATION. H. S. Green. Phys. Rev. 90, 270-3(1953) Apr. 15.

A method of field quantization is investigated which is more general than the usual methods of quantization in accordance with Bose or Fermi statistics, though these are included in the scheme. The commutation properties and matrix representations of the quantized field amplitudes are determined, and the energy levels of the field are de-

rived in the usual way. It is shown that spin-half fields can be quantized in such a way than an arbitrary finite number of particles can exist in each eigenstate. With the generalized statistics, the interchange of two particles of the same kind may or may not be physically significant, according to the type of interaction by means of which they are created or annihiliated. Physical consequences of the assumption that there are particles which obey the generalized statistics are briefly examined. (auth)

3645

A NONPERTURBATION APPROACH TO QUANTUM ELECTRODYNAMICS. S. F. Edwards. Phys. Rev. 90, 284-91 (1953) Apr. 15.

The equations governing the interaction of an electron with the electromagnetic fields are used in the form given by Schwinger (Proc. Natl. Acad. Sci. U.S. 37, 452(1951)) to derive a linear integral equation for the function Γ, whose kernel is expressed as a power series in α. The first approximation to this kernel is used and the resulting integral equation solved without recourse to perturbation theory. With the aid of the solution first approximations can be found for self-energy effects, which are now finite, and some discussion of the analytic behavior of these and related quantities is given. An application of the method to meson theory illustrates the classification of the types of integral equation which arise. The possibility of extending the method is discussed. (auth)

3646

SOME CONSEQUENCES OF GAUGE INVARIANCE. Masaaki Kawaguchi and Nobumichi Mugibayashi. Progr. Theoret. Phys. (Japan) 8, 212-20(1952) Aug.

A simple theorem is stated to expand the matrix element for a process concerning any number of photons or external electromagnetic fields into the independent gage-invariant terms. It turns out that the number of such terms is uniquely determined by the initial and final states of the process, regardless of the intermediate states and the type of interaction. There are, for example, 4, 14, and 10 independent gage-invariant terms for the production of mesons of spin 0 and 1 by photons and Compton scattering, respectively. Some of the well-known absolute selection rules for meson decays can also be derived from this gage-invariant expansion theorem. (auth)

3647

ON THE SELF-STRESS. Yasushi Takahashi and Hiroomi Umezawa. Progr. Theoret. Phys. (Japan) 8, 193-204(1952) Aug. (cf. NSA 7-1027).

The reason why the difficulty pointed out by Pais (Revs. Modern Phys. 21, 445(1949)) arises is analyzed by a general discussion independent of any approximation for the self-stress of an arbitrary elementary particle interacting with arbitrary fields. To do this, the Pais-Epstein-Sawada formula is generalized for the system with more intricate interaction. The difficulty due to the process of the vacuum-polarization type on account of which the non-vanishing self-stress has been given is also discussed. (auth)

3648

A NOTE ON THE S-MATRIX IN THE THEORY OF THE NON-LOCAL INTERACTION. T. Ouchi. Progr. Theoret. Phys. (Japan) 8, 253-4(1952) Aug.

The results of Rayski (Phil. Mag. (7) 42, 1289(1951)) and Shono and Oda (Progr. Theoret. Phys. (to be published)) on the S matrix for the electromagnetic and spinor fields with non-local interaction agree except in the electron self-energy. This note examines the origin of the discrepancy between them. (L.M.T.)

3649

NOTE ON THE STRUCTURE OF THE INTERACTIONS BETWEEN UNSTABLE ELEMENTARY PARTICLES. S. Ôneda. Progr. Theoret. Phys. (Japan) 8, 255-6(1952) Aug.

The appearance of many unstable particles suggests that there are some sorts of regularities among the mass spectra of elementary particles. Pais (private communication) attempted to select and classify the interactions. His idea is extended here in a general way by use of known decay schemes, assuming that no stable particles heavier than nucleons exist. Starting from known particles, each unstable particle is assigned a number λ which defines the mode of interactions with nucleons and lighter stable particles (electron, neutrino, γ ray, and possibly μ^0 meson). (L.M.T.)

3650

HYPOTHESIS OF A NEW PARTICLE, THE ELECTRINO. D. Ivanenko and N. Kolesnikov. Doklady Akad. Nauk S.S.S.R. 87, 923-5(1952) Dec. 21. (In Russian)

Under certain conditions (β-transition energy $> m_e c^2$) β decay by way of electrino emission can compete with the usual β decay process. However, at extremely high energies the usual β decay begins to predominate as a strong function of energy. (G.Y.)

3651

ANALYTICAL REPRESENTATION OF SPIN. T. Yamamoto. Progr. Theoret. Phys. (Japan) 8, 258-9(1952) Aug.

This note briefly treats the transformation of spin operators into those of angular momentum, from which it is suggested that the concept of spin may be interpreted as an angular momentum in the complex space of zero radius. (L.M.T.)

3652

ON YUKAWA'S THEORY OF NON-LOCAL FIELD. H. Shimazu and O. Hara. Progr. Theoret. Phys. (Japan) 8, 385-6(1952) Sept.

In a previous article (Progr. Theoret. Phys. (Japan) 5, 1055(1950)) the authors conjectured the equivalence of non-local and local fields by showing that the self-energy of a local charged spinor particle due to a non-local neutral scalar field diverges in the same manner as that due to a local neutral scalar field. Yukawa (Progr. Theoret. Phys. 6, 133(1951)) pointed out that the conjecture is based on a special example in which the non-local field appears only linearly in the interaction Lagrangian density, and felt that the investigation into the interaction of two non-local fields would reveal the characteristic features of his non-local theory. However, the calculation of the self-energy of a non-local charged scalar particle due to a non-local neutral scalar field gave the same result as before in contradiction to Yukawa's anticipation. The reason for this is discussed here. (L.M.T.)

3653

LINEAR MESON WAVE EQUATION IN DE SITTER SPACE. S. A. Raje. Progr. Theoret. Phys. (Japan) 8, 384-5(1952) Sept.

Dirac (Ann. Math. 36, 657(1935)) developed an expression for the linear wave equation for the electron in de Sitter space. Proceeding analogously, a similar equation is presented here for the meson in de Sitter space. From this the current-charge density, the momentum-energy density, and the constant of motion giving the spin momenta are determined. Finally, the second-order wave equation is derived. (L.M.T.)

3654

NON-LOCAL FIELD AND NON-LOCAL INTERACTION. Y. Katayama. Progr. Theoret. Phys. (Japan) 8, 381-2(1952) Sept.

Kristensen and Møller (Kgl. Danske Videnskab. Selskab. Mat.-fys. Medd. (to be published)) showed that there is a possibility of removing the divergence difficulties encountered in non-local field theory by introducing the suitable

form factor from the only non-local interaction. Tokuoka and Katayama (Progr. Theoret. Phys. (Japan) 5, 132(1951)) indicated that if the associated local lagrangian be constructed from the non-local one, it is possible to transform the non-local field to the non-local interaction. This note gives the relations between these two theories and then pursues the possibilities of the generalization of the non-local field theory from the standpoint of the convergence problem. (L.M.T.)

3655
SELECTION RULES FOR DECAYS OF π-MESONS AND V-PARTICLES. Tetsuo Hamada and Masao Sugawara. Progr. Theoret. Phys. (Japan) 8, 363-79(1952) Sept.

Making use of the general principle of invariance under space rotation and inversion, the decay of a π meson into two fermions and of a V particle (assuming spin $\frac{1}{2}$) into one boson and one fermion are investigated. The subject of interest is whether any of these decay processes can be made forbidden by assigning appropriate parities to various fermions, as has been remarked by Yang and Tiomno (Phys. Rev. 79, 495(1950)). It is found that there exists no such possibility, that is, there is no reasonable assignments of parities which make any processes forbidden. This result is reexamined in the light of charge-independence hypothesis, in which π-meson fields are considered to interact charge-symmetrically with nucleon and lepton fields. It is found, however, that the introduction of this hypothesis does not better the situation at all. Several definite conclusions are drawn on the isotopic angular momenta of V particles from this hypothesis. Discussions are also made on the possibility of the proposed model in which μ mesons and V particles are assumed to be the excited states of leptons and nucleons, respectively. (auth)

3656
A NEW ATTEMPT ON THE SELF-ENERGY PROBLEM OF THE PHOTON. Osamu Hara and Haruo Shimazu. Progr. Theoret. Phys. (Japan) 8, 265-79(1952) Sept.

The self-energy problem of the photon is investigated using an idea of renormalizing the light velocity. It is shown that the self energy ΔE and the alteration of the light velocity due to the interaction Δc are connected by the relation

$$E + \Delta E = p(c + \Delta c),$$

where E, p, and c are the energy, the momentum, and the velocity of a free photon respectively. The renormalization of c is presented on the ground of this relation, and a theory of the interaction of the electromagnetic and electron fields is given in a form which is invariant under Lorentz and a gage transformation, and is free from the divergence of the self energy of the photon. The description of the Lagrangian formalism of the theory is presented. Calculations in this paper are restricted to the e^2 approximation. (auth)

3657
EFFECT OF A SHORT-RANGE REPULSION ON LOW ENERGY SINGLET NUCLEON-NUCLEON SCATTERING. M. H. Hull, Jr. and A. Herschman. Phys. Rev. 90, 482-5 (1953) May 1.

Modifications needed in order that low-energy singlet scattering be described when a repulsive core is introduced in a phenomenological nucleon-nucleon interaction are investigated. It is found that if a square well is used to represent the attractive part of the interaction, a range of potential parameters allows a description of the data and also satisfies the charge-independence hypothesis. When the Yukawa potential is investigated, the assumption of charge independence is more restrictive, and a single set of parameters is found. (auth)

3658
THE EFFECT OF THE FINITE DE BROGLIE WAVE-LENGTH IN THE THEORY OF BETA-DECAY. M. E. Rose and C. L. Perry. Phys. Rev. 90, 479-82(1953) May 1.

An accurate numerical evaluation of the Z and energy-dependent parts of the correction factors for allowed and forbidden β transitions has been carried out. The range of parameters considered is: 88 values of Z (from 10 to 96 inclusive in steps of 2 and for positrons ($Z < 0$) as well as electrons ($Z > 0$)); 33 values of p, the electron momentum, in mc units ($0.1 \leq p \leq 25$) for $|Z|$ through 24 and 31 values of p ($0.1 \leq p \leq 15$) for $|Z| > 24$; four values of j (the electron momentum ($\frac{1}{2} \leq j \leq \frac{7}{2}$). For each value of Z, p, and j the six wave-function combinations (L_ν, M_ν, N_ν, P_ν, Q_ν, R_ν) needed for the general mixed β interaction are obtained. For the given range of j, analysis of β spectra can be carried out through third forbidden transitions. The results given here show that the theoretically allowed spectra should be modified by an energy-dependent factor. For not-too-low maximum energies, this modification in the shape of the allowed β spectrum amy be observable with presently attainable precision. (auth)

3659
ON THE DAMPING OF VIRTUAL NUCLEON-PAIR FORMATION IN PSEUDOSCALAR MESON THEORY. K. A. Brueckner, M. Gell-Mann, and M. Goldberger. Phys. Rev. 90, 476-8(1953) May 1.

The modifications of the propagation characteristics of a nucleon which result from the presence of a strongly coupled mesonic self-field are estimated from the consideration of a simple subset of radiative corrections to the nucleon-propagation function. It is found that reactive effects markedly inhibit nucleon-pair formation so that the contributions from the pseudoscalar coupling term which do not involve nucleon pairs are strongly enhanced relative to those involving pair formation. In addition, the meson-pair coupling term, which results from nonrelativistic approximations to the relativistic linear coupling term and is intimately connected with nucleon-pair formation, is strongly damped. The relation of this result to the nonrelativistic theory of Wentzel is discussed. (auth)

PATENTS

CHEMISTRY

3660
POCKET RADIATION METER. F. R. Shonka (to the U. S. Atomic Energy Commission). U. S. Patent 2,634,374, April 7, 1953.

The combination of an adjustable electrometer employing a preformed scale in conjunction with a charging switch providing a seal, which is gas-tight at all times, makes it possible to mass produce a reliable and accurate pocket-type radiation dosimeter.

3661
PREPARATION OF ZIRCONIUM TETRAFLUORIDE. H. A. Wilhelm and K. A. Walsh (to the U. S. Atomic Energy Commission). U. S. Patent 2,635,037, April 14, 1953.

A method is described for the production of anhydrous ZrF_4 which may be used to prepare Zr metal. An aqueous solution of Zr oxychloride is treated with aqueous HF to form a Zr fluoride precipitate which is removed and dried at 100 to 110°C and subsequently heat treated for several hours at a temperature up to 575°C in the presence of dry HF.

3662
PRODUCTION OF GRANULAR BERYLLIUM FLUORIDE. K. A. Walsh and H. A. Wilhelm (to the U. S. Atomic Energy Commission). U. S. Patent 2,635,944, April 21, 1953.

This process for converting fluffy Be hydroxide to granular fluoride, comprises contacting a thin bed of the hydroxide with anhydrous HF for a period of several hours at about 300 to 350°C.

3663
PREPARATION OF POWDERED THORIUM. H. A. Wilhelm and P. Chiotti (to the U. S. Atomic Energy Commission). U. S. Patent 2,635,956, April 21, 1953.

In converting massive metallic Th to powder metal, the metal is first treated in a furnace with hydrogen at slightly superatmospheric pressure and a temperature of about 600 to 650°C to form a lower hydride, ThH_2. The introduction of H is continued while lowering the temperature slowly to about 100°C, thereby forming a loosely packed powderlike compound of ThH_{3-4}. Subsequently the introduction of H is discontinued, the furnace is evacuated, and the temperature raised to about 700°C while maintaining vacuum, thereby producing Th metal in powder form.

3664
RARE EARTH SEPARATION BY ANION EXCHANGE. E. H. Huffman and R. L. Oswalt (to the U. S. Atomic Energy Commission). U. S. Patent 2,636,044, April 21, 1953.

This process for the separation of rare-earth elements from each other comprises adsorbing rare earth-citrate complexes from an acidic aqueous citrate solution on a strong base-type anion-exchange resin and selectively eluting the rare-earth complexes in the order of increasing rare-earth atomic number by means of a citric acid solution having a pH value in the range of ~1.5 to 3.0.

3665
URANIUM COMPLEXES OF HETEROCYCLIC DIKETONES. H. I. Schlesinger and H. C. Brown (to the U. S. Atomic Energy Commission). U. S. Patent 2,636,886, April 28, 1953.

Methods are described for preparing the tetravalent and hexavalent complexes of U with various heterocyclic beta diketones where the heterocyclic radical is selected from the group consisting of furan, thiophene, pyrrole, coumarone, and the like, such as furoylacetone.

3666
PRODUCTION OF URANIUM TETRAFLUORIDE. A. D. Tevebaugh and F. Vaslow (to the U. S. Atomic Energy Commission). U. S. Patent 2,638,406, May 12, 1953.

This process for producing UF_4 from UF_6 comprises contacting the UF_6 at a moderately elevated temperature with a hydrogen halide selected from the group of HCl, HBr, and HI.

MINERALOGY, METALLURGY, AND CERAMICS

3667
VACUUM DIE-CASTING. R. F. Plott (to the U. S. Atomic Energy Commission). U. S. Patent 2,637,882, May 12, 1953.

This vacuum die-casting machine employs an air-tight sealing member not requiring pressure by either die section. The seal remains relatively cool and thereby substantially free from heat damage.

PHYSICS

3668
DEVICE FOR SEPARATING PARTICLES OF DIFFERENT MASSES. W. Altar (to U. S. Atomic Energy Commission). U. S. Patent 2,633,539, March 31, 1953.

In a device and method for separating particles of different masses such as isotopes, a beam of charged particles, which may be pulsed, passes through an alternating electric field, a field-free space, then a second alternating field, the fields being substantially synchronized and having substantial components parallel to the beam. The time spent in traversing the field-free space is some integral number of half-periods of the alternating fields. The beam then passes through a decelerating chamber and finally through a perpendicular magnetic field whereby particles of desired mass are directed to a collecting chamber.

3669
LEAKAGE TESTING METHOD. J. P. Howe, A. B. Greninger, and R. F. Plott (to U. S. Atomic Energy Commission). U. S. Patent 2,633,740, April 7, 1953.

A method is described for testing a jacketed body for airtightness, particularly the seam weld.

3670
HIGH-FREQUENCY SHUNT. Q. A. Kerns (to the U. S. Atomic Energy Commission). U. S. Patent 2,634,307, April 7, 1953.

The h-f shunt described is capable of effectively isolating a meter from inductive voltages produced therein, thereby providing a voltage signal independent of frequency variations.

3671
PREPARATION OF URANIUM BROMIDE. J. E. Powell (to the U. S. Atomic Energy Commission). U. S. Patent 2,635,035, April 14, 1953.

This method for the preparation of UBr_4 comprises reacting U nitride with Br at a temperature of about 450°C or above.

3672
METHOD AND APPARATUS FOR STEREOSCOPIC RECOMPOSING AND MEASURING. W. M. Powell and H. P. Hernandez, Jr. (to the U. S. Atomic Energy Commission). U. S. Patent 2,635,339, April 21, 1953.

A method and apparatus are described for the recording, under a given set of optical conditions, of a full-size visual image of the path of a particle in space and the recomposing in full size of the image under a substantially identical set of optical conditions.

3673
PULSE EQUALIZER. B. Smaller (to the U. S. Atomic Energy Commission). U. S. Patent 2,636,118, April 21, 1953.

This device for measuring the coincidences of electrical pulses transforms pulses of random amplitudes into pulses of equal amplitude, the delay time for all pulses being essentially constant.

3674
ION SOURCE UNIT. J. D. Gow and J. S. Foster (to the U. S. Atomic Energy Commission). U. S. Patent 2,636,990, April 28, 1953.

The ion source unit described employs a magnetic field to influence the electron discharge therein and an appertured negative electrode immediately beyond an appertured cathode for the removal of ions from the center of ion density.

3675
FAST COUNTING CIRCUIT. M. J. Jakobson (to the U. S. Atomic Energy Commission). U. S. Patent 2,636,993, April 28, 1953.

This counter identifies particular pulses in the presence of high background noise by means of a pair of scintillation crystals aligned in the path of the beam of particles to be counted and a pair of photomultiplier tubes connected one to each of the crystals.

3676
APPARATUS FOR ATTACHING FILAMENTS TO ELECTRODES IN MACHINES FOR COATING WITH METAL VAPORS. Z. M. Shapiro (to the U. S. Atomic Energy Commission). U. S. Patent 2,637,297, May 5, 1953.

Detachable filament connectors are provided for attaching a filament to an electrode, useful in the hot-wire method of preparing metals by the thermal decomposition of a volatile halide. The connectors are shaped to minimize heat construction from the filament.

3677

APPARATUS FOR ATTACHING FILAMENTS TO ELECTRODES IN MACHINES FOR COATING WITH METAL VAPORS. Z. M. Shapiro (to the U. S. Atomic Energy Commission). U. S. Patent 2,637,298, May 5, 1953.

A connector is described similar to that of the preceding abstract, but with spaced extensions terminating near the filament attachment point whereby deposited metal may progressively bridge their ends.

3678

METHOD OF DISPERSING MATERIALS IN WATER. J. De Ment (to the U. S. Atomic Energy Commission). U. S. Patent 2,637,536, May 5, 1953.

The method comprises introducing into the liquid a mixture of solid carbon dioxide and the material to be dispersed.

3679

IMPROVED WINDOW FOR ALPHA PARTICLE COUNTERS. C. J. Borkowski (to the U. S. Atomic Energy Commission). U. S. Patent 2,638,560, May 12, 1953.

A thin nylon foil window is described which is substantially transparent to α particles and soft β's and sufficiently robust to withstand an appreciable pressure differential.

NEW NUCLEAR DATA

NOTICE

The New Nuclear Data presented here completes the material necessary for the second 1953 quarterly cumulation which will appear in Vol. 7, No. 12B. Because of a proposed reorganization of the Nuclear Data Group these lists will be temporarily suspended with this issue. It is anticipated that they will be resumed shortly without lapse of coverage.

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses.

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers.

For a list of the abbreviations used in this section, see NSA, Vol. 7, No. 1, page "SUPPLEMENT 1".

Lu^{176} 71 105 2.4×10^{10}y

τ_{β^-} **2.0×10^{10}y** 92 β^-s/sec/g Lu* 200 γ's/sec/g Lu

β^- ~0.4 a

γ 100 † **0.20** scin

100 † **0.32**

(0.32γ) (0.20γ) (0.4β) (γ)

No 0.52γ (< 10%) 0.090γ not observed

x ray/disintegration ~0.35

accounted for by γ conversion

J.R.Arnold, T.Sugihara, Phys. Rev. 90, 332(1953); *A.D.Suttle, Jr., Ibid.

Lu^{177} 71 106

(0.206γ) (0.112γ) b = - 0.20

I = 5/2, 7/2, 3/2 (E)1, (E)2

T.Wiedling, Arkiv Fysik 6, 39(1953).

Hf^{181} 72 109

γ (0.48) $\tau = 1.04\times10^{-8}$ s $(ce^-)(\gamma)$

T.C.Engelder, Phys. Rev. 90, 259(1953).

γ (0.34), (0.48) $\tau = 1.06\times10^{-8}$ s $\gamma\gamma$

H. deWaard, Physica 18, 1151(1952).

~16^{ms} level produced by Ta(γ,γ') $E_\gamma \lesssim 6.5$ scin

H.N.Brown, R.A.Becker, Phys. Rev. 90, 328(1953).

W^{185} 74 111

γ (0.13) $\tau < 2\times10^{-9}$ s $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259(1953).

W^{187} 74 113

τ **24.0^h** W^{186} (pile n,γ)

β^- * 80% **0.622** $s\pi\sqrt{2}$

20% **1.304**

γ		K/L		K/L
	0.072		**0.513**	
	0.106		**0.552** ?	
	0.114		**0.619**	4
	0.134	5.5	**0.626**	
	0.206		**0.686**	5
	0.239		**0.774**	
	0.246		**0.866**	
	0.480	4.2		

L_I/L_{III} ~60 for 0.134γ

J.M.Cork, M.K.Brice, W.H.Nester, J.M.LeBlanc, D.W.Martin, Phys. Rev. 89, 1291(1953); *A.E. Stoddard, Ibid.

Re^{185} 75 110

I 5/2 Mic

$q(Re^{185})/q(Re^{187}) = 1.08$

A.Javan, G.Silvey, C.H.Townes, A.V.Grosse, BAPS 28, 2, J8(1953).

Re^{187} 75 112

I 5/2 Mic

$q(Re^{185})/q(Re^{187}) = 1.08$

A.Javan, G.Silvey, C.H.Townes, A.V.Grosse, BAPS 28, 2, J8(1953).

β^- ~0.034 ppl

B.Gauthe, J.M.Blum, Compt. rend. 236, 1255(1953).

$_{5}Re^{187}_{112}$ β^- ~0.40* 3rd forbidden? pc
No x ray or γ
Spectral shape similar to Rb^{87}
β counts less than background

D.Dixon, McNair, quoted by S.C.Curran, Physica 18, 1161(1952); Nature 170, 512(1952).
*Decimal point as assigned in these references.

Re^{188}_{75} $_{22}m^{113}$ τ_1 18.7m Re(slow n)
γ 0.06 α~2 a
p $18^h Re^*$ Szilard-Chalmers chem

A.Flammersfeld, Z. Naturf. 8a, 217(1953); *W.Herr, Z. Naturf. 7a, 819(1952).

Os^{185}_{76} $_{109}$ γ 0.163 s ce$^-$
0.234
0.645 K/L~6
0.879

J.M.Cork, J.M.LeBlanc, W.H.Nester, D.W.Martin, M.K.Brice, Phys. Rev. 90, 444(1953).

Os^{193}_{76} $_{117}$ γ 0.073 L_I/L_{II}~1 0.404 s ce$^-$
0.106 L/M~3 0.460
0.139 K/L~5 0.558
0.251
0.281 K/L~10
0.321 K/L~8

J.M.Cork, J.M.LeBlanc, W.H.Nester, D.W.Martin, M.K.Brice, Phys. Rev. 90, 444(1953).

Ir^{192}_{77} $_{115}$ 70^d β^- 16% 0.24 s
40% 0.54
44% 0.67
No 0.84β^- (<0.4%)

	K*	L*	M*
γ 0.137		~1.8	
0.202	~0.65		
0.207	4.3	4.0	1.2
0.296	16	7.4	
0.309	15	6.7	
0.317	34	18	5.5
0.401	~0.1		
0.420	~0.1		
0.440	~0.05		
0.468	7.7	2.2	0.64
0.488	0.50		
0.590	0.45	0.07	
0.605	1.4	0.25	
0.613	0.56	0.10	
0.880	4.4**	1.1**	~0.5**

*$(ce^-/\beta) \times 10^{-3}$ **$(ce^-/\beta) \times 10^{-6}$

A.A.Bashilov, N.M.Anton'eva, B.S.Dzhelepov, Izvest. Akad. Nauk Ser. Fiz. SSSR 16, 264(1952).

Ir^{194}_{77} $_{117}$ γ 100† 0.33 scin
100† 1.48 (E)2 98% (M)1 2%
1† {1.8 {2.1
(1.48γ)(0.33γ)(θ) I = 2,2,0

J.J.Kraushaar, M.Goldhaber, Phys. Rev. 89, 1081 (1953).

Pt^{191}_{78} $_{113}$ τ 3.2^d Ir(10-Mev d) chem, not Pt(≤22-Mev γ)
γ 0.062 0.129 0.350 s π ce$^-$
0.082 0.171 0.359
0.094 0.178 0.408
0.125 0.267 0.455
No 0.042γ 0.537

J.B.Swan, W.M.Portnoy, R.D.Hill, Phys. Rev. 89, 907A; 90, 257(1953).

Pt^{193}_{78} $_{115}$ 4.3^d τ_1 4.5^d Ir(10-Mev d) chem Pt(≤22-Mev γ)
γ IT 0.135 M4 s π
K: L_I : L_{II}: M: N = 10 : 12 : 24 : 13 : 6

J.B.Swan, W.M.Portnoy, R.D.Hill, Phys. Rev. 89, 907A; 90, 257(1953).

g.s. τ_2 $>74^d$ or $<1^h$
Measurements outside these limits obscured by 72^dIr and 80^mPt

J.B.Swan, W.M.Portnoy, R.D.Hill, Phys. Rev. 90, 257(1953).

Au^{196}_{79} $_{117}$ 5.6^d γ (0.33) (E)2 95% (M)1 5% $\gamma\gamma(\theta)$
(0.36) (E)2 $\gamma\gamma(\theta)$
$\gamma\gamma(\theta)$ I = 2,2,0
No crossover γ (<1%) scin
$\gamma\gamma(\theta)$ independent of phase and chemical structure

R.M.Steffen, Phys. Rev. 89, 665(1953); 89, 903A (1953).

Au^{198}_{79} $_{119}$ τ $2.697^d \pm 0.003$ Au(pile n)
Counted for 10 days β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

γ (0.68) (E)2 60% (M)1 40% $\gamma\gamma(\theta)$
(0.68γ)(0.41γ)(θ) I = 2,2,0

C.D.Schrader, E.B.Nelson, J.A.Jacobs, Phys. Rev. 90, 159(1953).

No ϵ_K (<0.5%) sl
from absence of Pt Auger e$^-$

C.D.Broyles, D.A.Thomas, S.K.Haynes, Phys. Rev. 89, 715(1953).

Hg^{203}_{80} $_{123}$ γ (0.28) $\tau < 2 \times 10^{-9}$ s $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259(1953).

Tl^{204}_{81} $_{123}$ τ $2.71^y \pm 0.05$ Tl(pile n)
Counted for 8 months β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

Tl^{206}_{81} $_{125}$ τ $4.19^m \pm 0.02$ Tl(pile n)
Counted for 25 half-lives β electroscope

B.W.Sargent, L.Yaffe, A.P.Gray, Can. J. Phys. 31, 235(1953).

Tl^{207} 81 126

τ $4.79^m \pm 0.02$ Bi^{211} recoil
Counted for 25 half-lives β electroscope

B.W.Sargent, L.Yaffe, A.P.Gray, Can. J. Phys. 31, 235(1953).

Tl^{208} 81 127

(0.58γ) (2.62γ) polarization-direction
I = 4^+, 2^+, 0^+

J.J.Kraushaar, M.Goldhaber, Phys. Rev. 89, 1081 (1953).

Pb^{205} 82 123

Levels Pb^{206}(d,t) E_d = 14 a pc
0.3
0.8
1.8

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Pb^{206} 82 124

Levels Pb^{207}(d,t) E_d = 14 a pc
0.9 2.2
1.4 3.0
1.7

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Pb^{207} 82 125

Levels	Pb^{206}(d,p)	Pb^{208}(d,t)
	0.6	0.6
	1.0	1.0
	2.8	1.6
	3.6	2.3
	4.4	
	4.7	
	5.3	

E_d = 14 a pc

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Pb^{208} 82 126

Levels Pb^{207}(d,p) E_d = 14 a pc
3.4 5.4
3.6 6.1
5.1

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Pb^{209} 82 127

Levels Pb^{208}(d,p) E_d = 14 a pc
0.8 2.0
1.6 2.5

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Pb^{210} 82 128

β^- 0.024 pc
F-K plot linear to 8.5 kev

E.Huster, Naturwiss. 40, 197(1953).

γ (0.047) L : M : N = 100 : 23 : 6 EA
ce^- 0.0110 not assigned
No ce^-(0.014-0.030) < 1% of ce^-_L(0.0467γ)

Y.Kobayaski, G.Miyamoto, J. Phys. Soc. Japan 8, 135(1953); 273(1953).

(L x ray) / (0.047γ) = 6.3 pc
Peaks seen ascribed to nuclear γ's of
16.1, 24, 30.7, 37.0, 41.5, 62.5 kev

P.E.Damon, R.R.Edwards, Phys. Rev. 90, 280(1953).

Pb^{212} 82 130

γ (0.238) $\tau < 2 \times 10^{-11}$ s βe^-_K

R.L.Graham, R.E.Bell, Can. J. Phys. 31, 377(1953).

Pb^{214} 82 132

β^- 0.35 ? s βe^-
33 † 0.67
100 † ~0.73

γ 4.3* 0.241 s ce^-
4.8* 0.294
3.6* 0.350

[0.67β] [e_K(0.35γ)]
[0.73β] [e_K(0.29γ)]

*ce^- per 100 β^-

E.E.Berlovich, Izvest. Akad. Nauk Ser. Fiz. SSSR 16, 314(1952).

Bi^{208} 83 125

Bi(d,t) E_d = 14 a pc
Q values -1.17
-1.8
-2.2

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Bi^{210} 83 127 4.9^d

τ_2 $4.989^d \pm 0.013$ Bi(pile n)
Counted for 33 days β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

No 0.080γ (< 0.02% of β's) scin

D.G.E.Martin, G.Parry, Phil. Mag. 44, 344(1953).

Continuous γ spectrum scin
$\gamma(E_\gamma > 0.09)/\beta^- = 0.00084$

P.Bolgiano, L.Madansky, F.Rasetti, Phys. Rev. 89, 679(1953).

Bi(d,p) E_d = 15 scin
Q value 1.94
No higher energy p group (< 3% of Q = 1.94 group) but believed not g.s. Q

N.S.Wall, BAPS 28, 3, UA2(1953).

Bi(d,p) E_d = 14 a pc
Q values 1.94 -0.3
0.30 -0.8

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Bi^{212} 83 129

γ (0.040) $\tau < 7 \times 10^{-11}$ s αe^-_L

R.L.Graham, R.E.Bell, Can. J. Phys. 31, 377(1953).

Bi^{214} 83 131

β^-				
	81%	~1.55	Ra^{226} source	a $\beta\gamma$
	< 10%	(2.56)		a
	19%	(3.17)		a

$E_{d/s}$ = 3.17

A.H.Wapstra, Physica 18, 1247(1952).

$_{83}Bi^{214}_{131}$

γ 0.605 1.379 sπ Cpt line
0.699* 1.504* 1.832*
0.770 1.627** 2.116**
0.907 1.679** (2.193)
(1.120) 1.727** 2.42**
1.247 (1.761)

( ) Used as standards
* ce^-_K seen by Ellis but assigned otherwise
** ce^- seen by Ellis but not assigned

M.Mladjenović, A.Hedgran, Physica 18, 1242(1952).

γ 1.1205 sπ ce^-_K
1.4158

$H_\rho = 4939.8 \pm 0.8$, 5874.4 ± 0.6 gauss cm

G.Lindström, A.Hedgran, D.E.Alburger, Phys. Rev. 89, 1303(1953).

Bi^{215} 83 132

τ 8^m d $0.9^m At^{219}$ p $2^{m3} Po^{215}$

E.K.Hyde, A.Ghiorso, Phys. Rev. 90, 267(1953).

Po^{206} 84 122

α 5% d $2.3^h Rn^{210}$

F.F.Momyer, UCRL-2060(1953).

Po^{210} 84 126

τ $138.39^d \pm 0.14$
Observed for 200 days calorimeter

D.C.Ginnings, A.F.Ball, D.T.Vier, J. Research Nat. Bur. Standards 50, 75(1953); J. Franklin Inst. 255, 241(1953).

Po^{218} 84 134

α 5.996 s

G.Bastin-Scoffier, J. Sant'ana-Dionisio, Compt. rend. 236, 1016(1953).

At^{211} 85 126

α 5.862

R.W.Hoff, F.Asaro, quoted by F.F.Momyer, UCRL-2060(1953).

At^{219} 85 134

τ 0.9^m d $21^m Fr^{223}$ chem
α 6.27 ic
$\alpha/\beta^- = 30$

E.K.Hyde, A.Ghiorso, Phys. Rev. 90, 267(1953).

Rn^{208} 86 122

τ 23^m p $4^h Po^{204}$ Th(340-Mev p)
ϵ ~80%
α ~20% 6.138 s

F.F.Momyer, UCRL-2060(1953).

Rn^{209} 86 123

τ 30^m p $5.7^h At^{209}$ Th(340-Mev p)
ϵ ~85%
α ~15% 6.04 s

F.F.Momyer, UCRL-2060(1953).

Rn^{210} 86 124

τ 2.7^h p $9^d Po^{206}$ Th(340-Mev p)
ϵ <5%
α >95% 6.036 s

F.F.Momyer, UCRL-2060(1953).

Rn^{211} 86 125

τ 16^h Th(340-Mev p)
ϵ 74%
α 17% 5.778 s
9% 5.847
γ 0.07 scin
0.15
0.40
0.60

F.F.Momyer, UCRL-2060(1953).

Rn^{212} 86 126

α 6.262 Th(340-Mev p) s

F.F.Momyer, UCRL-2060(1953).

Rn^{220} 86 134

α 6.278 s

G.Bastin-Scoffier, J.Sant'ana-Dionisio, Compt. rend. 236, 1016(1953).

Rn^{221} 86 135

τ 25^m Th(110-Mev p)
β^- ~80%
α ~20%

F.F.Momyer, UCRL-2060(1953).

Rn^{222} 86 136

α 5.482 s

G.Bastin-Scoffier, J.Sant'ana-Dionisio, Compt. rend. 236, 1016(1953).

Fr^{212} 87 125

α 24% 6.339 s
39% 6.387
37% 6.409

E.K.Hyde, F.Asaro, quoted by F.F.Momyer, UCRL-2060(1953).

Fr^{223} 87 136

α/β^- $\sim 4 \times 10^{-5}$

E.K.Hyde, A.Ghiorso, Phys. Rev. 90, 267(1953).

Ra^{213} 88 125

τ 2.7^m p $30^m Rn^{209}$ $Pb(C^{12})$
α 6.90 ic

F.F.Momyer, UCRL-2060(1953).

Ra^{224} 88 136

α 5.679 s

G.Bastin-Scoffier, J.Sant'ana-Dionisio, Compt. rend. 236, 1016(1953).

Ra^{226} 88 138

α 4.777 ± 0.004 s
Based on E_α(Po) = 5.299

G.Bastin-Scoffier, J.Sant'ana-Dionisio, Compt. rend. 236, 1016(1953).

Ac^{228} 89 139

β^- 2.18 sπ√2
γ 0.0888 $\tau > 0.01^s$
$E_{dis} = 2.24$
At least 6 lower energy β spectra observed

J.Kyles, C.G.Campbell, W. J. Henderson, quoted by N.Feather, Physica 18, 1241(1952).

Pa^{231} 91 140

γ	0.0273	$\alpha < 10$	E1 a
	0.0336		ce⁻, ppl
	0.0380 }	$L_I + L_{II} \simeq L_{III}$	E2
	0.0569 }		
	0.0635 }		
	0.0823	$L_I \simeq M_I$	
		Rel. intensity of ce⁻	
	0.102	$L_{II} : L_{III} : M = 2 : 2 : 2$	
	0.198	K : L = 2 : 5	
	0.259	K : L = 10 : 5	
	0.301	K : L : M = 100 : 20 : 7	
		$\alpha_K \sim 1.6$	M1
	0.331	K : L : M = 50 : 10 : 1	
		$\alpha_K \sim 1.6$	M1
	0.357	K : L = 10 : 2	
	0.383	K = 5	
Unassigned ce⁻		0.125, 0.135, 0.170	

P.Falk-Vairant, M.Riou, J. Phys. Radium 14, 65 (1953); P. Falk-Vairant, Compt. rend. 235, 796 (1952).

U

Neutron resonances (ev) E_n = 3.7 to 800 ev

6.6	$\sigma_0 = 5000$ $\Gamma = 0.05$
20	$\sigma_0\Gamma^2 = 4.5$
38	$\sigma_0\Gamma^2 = 8.5$

E.Hellstrand, R.Persson, Arkiv Fysik 6, 57(1953).

Pu^{241} 94 147

τ_{β^-} 13.0^y

From Am^{241} present 2.39 years after initial purification

D.R.MacKenzie, M.Lounsbury, A.W.Boyd, Phys. Rev. 90, 327(1953).

Pu^{243} 94 149

τ		4.98^h	Pu^{242}(pile n)	ion chem
β^-	12%	(~0.37)		
	35%	0.468		scin
	53%	0.57		
γ		0.085	$\alpha_L \leqslant 0.7$	scin
		~0.1	$\alpha_L > 10$	

(0.47β)(0.085γ) (0.085γ)(~0.1γ) (0.085γ)(L x rays)
No (0.57β^-)(0.085γ) No (0.57β^-) (L x rays)

D.W.Engelkemeir, P.R.Fields, J.R.Huizenga, Phys. Rev. 90, 6(1953).

Am^{241} 95 146

No 0.0334γ, 0.0380γ (< 0.1% of 0.0597γ) pc
Suggest lines seen* at 0.014, 0.019, 0.022 due to Am x rays, those at 0.033, 0.038 to La x rays

J.O.Newton, B.Rose, Phys. Rev. 89, 1157(1953).
*C.I.Browne, UCRL-1764(1952); F.Asaro, et al., Phys. Rev. 87, 277(1952).

Neutron Cross Sections

Reaction	σ Type	Value	Energy	Ref.
Hf(n)	σ_{el}	4.7	1.0	53w3
Ta^{181}(n,2n)	σ(8.0^{h}Ta)	0.9	14.5	53p1
W^{186}(n,γ)	σ(24^{h}W)	0.12	25 kev	53k4
Pt(n)	σ_t	graph	0.1 - 3	53w2
Pt^{198}(n,2n)	σ(18^{h}Pt)	3	14.5	53p1
Au(n)	σ_t	graph	0.1 - 3	53w2
	σ_t	5.1	14	53a1
Au^{197}(n,2n)	σ(5.6^{d}Au)	1.7	14.5	53p1
Hg(n)	σ_t	graph	0.1 - 3	53w2
	σ_t	graph	0.4 - 3.5	52j2
	σ_t	5.3	14	53a1
Tl^{205}(n,p)	σ(5.5^{m}Hg)	0.003	14.5	53p1
Pb(n)	σ_{el}	4.6	1.0	53w3
Pb(n,n')	σ(~3.5 Mev γ's)	~0.3	14	53b5
	σ(~2.5 Mev γ's)	~4	14	53b5
Pb(n)	σ_t	graph	3 - 13	53n1
	σ_t	5.8	14	53a1
	σ_t	4.22	55	53r2
	σ_t	4.87	85	53r2
	σ_t	table	37 - 153	53t2
	σ_t	2.88	400	53n2
Pb^{208}(n,p)	σ(3.1^{m}Tl)	0.001	14.5	53p1
Bi(n)	σ_{el}	4.8	1.0	53w3
	σ_t	graph	3 - 13	53n1
	σ_t	5.4	14	53a1
Bi^{209}(n,α)	σ(4.2^{m}Tl)	0.001	14.5	53p1
Ac^{227}(n)	σ_a	500	th	52p3
Th(n)	σ_t	graph	0.1 - 3	53w2
	σ_t	3.23	400	53n2
Th^{230}(n)	σ_a	30 - 60	pile	49h1
Pa^{230}(n)	σ_a	~1500	pile	47g1
Pa^{231}(n,$\gamma\beta^-$)	σ(70^{y}U)	290	pile	53e3
Pa^{232}(n,γ)	σ(27.4^{d}Pa)	~40	pile	53e3
U(n)	σ_t	graph	3.7 - 800ev	53h5
	σ_t	graph	3 - 13	53n1
	σ_t	3.26	400	53n2
U^{232}(n)	σ_a	< 500	pile	53e1
U^{232}(n,f)	σ_f	~80	th	53e1

47g1 A.Ghiorso, M.H.Studier, E.K.Hyde, priv. comm. Value assuming $\sigma/\beta^-(Pa^{230}) = 11.5$.

49h1 E.K.Hyde, A.H.Jaffey, priv. comm.

52j2 C.M.Johnson, J.K.Bair, H.B.Willard, J.D.Kington, ORNL-1365(1952).

52p3 H.Pomerance, ORNL-1415, 15(1952).

53a1 M.Ageno, G.Cortellessa, R.Querzoli, Nuovo Cim. 10, 281(1953).

53b5 M.E.Battat, R.W.Davis, A.H.Frentrop, LA-1507(1953).

53e1 R.Elson, W.Bentley, A.Ghiorso, Q. VanWinkle, Phys. Rev. 89, 320(1953).

53e3 R.Elson, P.A.Sellers, E.R.John, Phys. Rev. 90, 102 (1953). Based on $\sigma(Np^{237}) = 172$.

53h5 E.Hellstrand, R.Persson, Arkiv Fysik 6, 57(1953).

53k4 C.Kimball, B.Hamermesh, Phys. Rev. 89, 1306(1953).

53n1 N.Nereson, S.Darden, Phys. Rev. 89, 775(1953).

53n2 V.A.Nedzel, Phys. Rev. 89, 169(1953).

53p1 E.B.Paul, R.L.Clarke, Can. J. Phys. 31, 267(1953).
53r2 B.Ragent, W.I.Linlor, BAPS 28, 3, 03(1953).
53t2 A.E.Taylor, E.Wood, Phil. Mag. 44, 95(1953).
53W2 M.Walt, R.L.Becker, A.Okazaki, R.E.Fields, Phys. Rev. 89, 1271(1953).
53w3 M.Walt, H.H.Barschall, BAPS 28, 3, 09(1953).

Ground State Q's

Reaction	Standard	Value		Method	Ref.
$Mo^{92}(\gamma,n)Mo^{91}$	- -	-13.1	±0.1	thresh	53k3
$Mo^{92}(n,2n)Mo^{91}$	- -	-12.34		thresh	53b6
$Pb^{206}(d,t)Pb^{205}$	$Al^{27}(d,p)$	- 1.8	±0.1	range	53h6
$Pb^{206}(d,p)Pb^{207}$	$Al^{27}(d,p)$	+ 4.48	±0.05	range	53h6
$Pb^{207}(d,t)Pb^{206}$	$Al^{27}(d,p)$	- 0.42	±0.05	range	53h6
$Pb^{207}(d,p)Pb^{208}$	$Al^{27}(d,p)$	+ 5.14	±0.05	range	53h6
$Pb^{208}(d,t)Pb^{207}$	$Al^{27}(d,p)$	- 1.10	±0.05	range	53h6
$Pb^{208}(d,p)Pb^{209}$	$Al^{27}(d,p)$	+ 1.65	±0.05	range	53h6

53b6 J.E.Brolley, Jr., Phys. Rev. 89, 877(1953); 88, 618 (1952).
53h6 J.A.Harvey, Can. J. Phys. 31, 278(1953).
53k3 L.Katz, R.G.Baker, R.Montalbetti, Can. J. Phys. 31, 250(1953).

Packing Fraction Differences, Δf, in Units 10^{-4} amu

Doublet	Δf	Ref.
$Zr^{92} - W^{184}$	-7.59 ±0.02	53g1
$Zr^{94} - Os^{188}$	-7.59 ±0.01	53g1
$Zr^{96} - Os^{192}$	-7.48 ±0.02	53g1
$Mo^{92} - W^{184}$	-7.44 ±0.02	53g1
$Mo^{94} - Os^{188}$	-7.72 ±0.02	53g1
$Mo^{96} - Os^{192}$	-7.86 ±0.01	53g1
$Ru^{96} - Os^{192}$	-7.55 ±0.02	53g1
$Ru^{102} - Pb^{204}$	-8.02 ±0.03	52h7
$Ru^{104} - Pb^{208}$	-7.96 ±0.01	52h7
$Rh^{103} - Pb^{206}$	-7.94 ±0.01	52h7
$Pd^{102} - Pb^{204}$	-7.94 ±0.04	52h7
$Pd^{104} - Pb^{208}$	-8.05 ±0.01	52h7
$W^{184} - Zr^{92}$	+7.59 ±0.02	53g1
$W^{184} - Mo^{92}$	+7.44 ±0.02	53g1
$Os^{188} - Zr^{94}$	+7.59 ±0.01	53g1
$Os^{188} - Mo^{94}$	+7.72 ±0.02	53g1
$Os^{192} - Zr^{96}$	+7.48 ±0.02	53g1
$Os^{192} - Mo^{96}$	+7.86 ±0.01	53g1
$Os^{192} - Ru^{96}$	+7.55 ±0.02	53g1
$Pb^{204} - Ru^{102}$	+8.02 ±0.03	52h7
$Pb^{204} - Pd^{102}$	+7.94 ±0.04	52h7
$Pb^{206} - Rh^{103}$	+7.94 ±0.01	52h7
$Pb^{208} - Ru^{104}$	+7.96 ±0.01	52h7
$Pb^{208} - Pd^{104}$	+8.05 ±0.01	52h7

52h7 B.G.Hogg, H.E.Duckworth, Can. J. Phys. 30, 637(1952).
53g1 J.S.Geiger, B.G.Hogg, H.E.Duckworth, J.W.Dewdney, Phys. Rev. 89, 621(1953).